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FRANKLIN JOURNAL,

AND

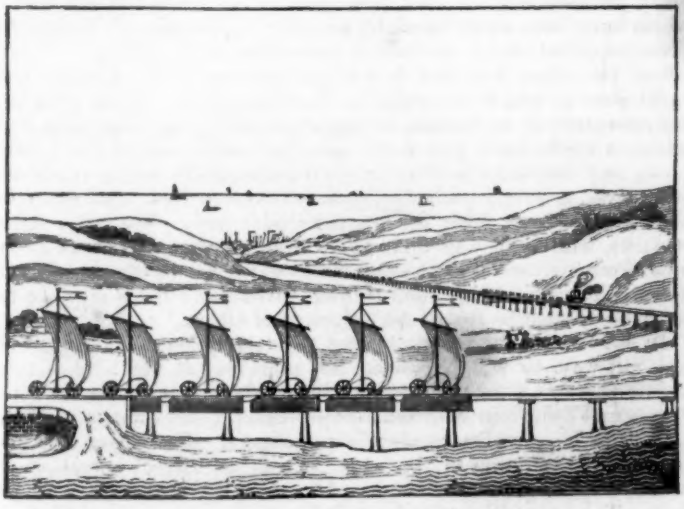
AMERICAN MECHANICS' MAGAZINE;

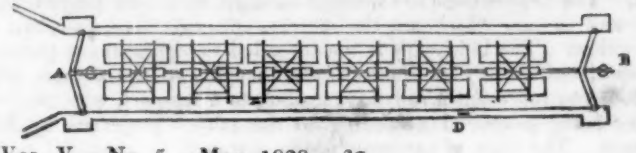
DEVOTED TO THE USEFUL ARTS,

Internal Improvements, and General Science.

MAY, 1828.

Proposed scheme of an Iron Rail-way, constructed on PALMER'S *plan, in which the force of the Wind may be occasionally used as an auxiliary power.*





We are not among the number of those who consider the pages as wasted, which are employed in the publication of the whimsies of speculators in mechanics, even when we are convinced that they are incapable of being reduced to practice. Of this description are many of the schemes brought forward in some of those journals which are published in London, for the particular benefit of the operative classes. To detect error is to be in the highway to truth, both in moral and in natural philosophy; and we are confident, that some of the absurdities, which intelligent editors have admitted into their pages, have frequently, in the investigations which they have induced, advanced the cause of truth, much more than it would have been promoted by confining these works to those principles which are admitted as orthodox.

We seem, indeed, as far from having a standard of orthodoxy in mechanics, as we are on those subjects to which the term is most frequently restricted. Learned doctors in science, are not agreed with respect to what is the *true faith*, in the crank motion, in the maximum effect of falling water, and in upwards of *thirty-nine* other *articles;* and those who are less learned, must be allowed to dispute, upon minor points, and to acquire knowledge, in the same way in which it has been acquired by their seniors; that is, by the use of their understandings, in advancing from what is known, to that which is unknown. It is only when those who assume the character of grave philosophers, advance principles which contradict the truths which have been established by accurate experiment or legitimate deduction, that we are inclined to animadvert with severity. Every editor has often felt that it was no easy matter to discover the exact point at which he ought to close his pages. When what we are convinced is erroneous, is supported with great ingenuity and talent, a writer has a just claim upon the conductors of the public press, and they must be excused from assuming the invidious station of umpires, or even from feeling themselves compelled, in all cases, to avow their dissent, from the doctrines advanced. We make these remarks, with a view to their application to what we borrow from other journals, as well as to some things which we present as original communications. When, and to what particular articles they are to be applied, must be left to the judgment of others.

In our last number, we published the description of an improved iron rail-way, by H. R. Palmer: the engraving at the head of this article presents a proposed application of the single rail in the conveyance of fish, from Brighton, or elsewhere, to the London market, as well as for carrying goods and passengers. The writer also believes that the power of the wind, as well as that of horses, or of steam, may frequently be employed in carrying his scheme into effect. The propositions are brought forward as a new project, in a tone and manner which suit the subject, and, therefore, do credit to the writer. The landscape is not intended to represent any particular spot, but merely to illustrate the thoughts of the author; it is intended to represent a rail-way, leading to a sea-port, with the carriages being propelled according to the modes projected by Mr. Palmer. The train of carriages in the distance, is supposed to be

drawn by a horse, the next by a steam engine, and that in the fore ground is represented as furnished with sails.

"Sailing over land," observes the writer, "is not a new idea, nor is it new in practice. For more than a hundred years, in some parts of Holland, four-wheeled carriages have been propelled by the wind over the common ground, on level plains. If the Hollanders, have found it practicable, or advantageous, to sail in this clumsy unimproved way, how much more practicable and advantageous would it be to bring into use the admirable means furnished us by Mr. Palmer, in his new rail-way, in which the friction, or resistance to the motion of the carriages, is reduced to one-twentieth part; or rather, wherein the facilities are increased in the reverse proportion? If in Holland, as is stated, they could sail, after their manner, twenty miles in an hour, with a good wind—with what an astonishing velocity might not the vessels, or carriages, sail on the proposed rail-way, when impelled by an equal power! As objections will, no doubt, be raised on account of the variableness of the wind, I must repeat, that I only propose it as an *auxiliary* power. It would rarely happen that the wind was not favourable in going, or returning, as a side wind would answer the purpose. I would propose in the absence of a steam engine, (which every proprietor of a train of carriages might not be able to afford,) that a horse should always be in attendance; so that when employed in drawing a train along the rail, if a breeze of wind should spring up, the sails might be spread; and the horse clapped into a carriage properly constructed to accommodate his noble person, where, in comfort, feasting over his bag of corn, his frame would be re-invigorated for fresh exertion, should the wind happen to fail.

"Having now given the outline of my first project, and being fearful of wearying the patience of your readers, I proceed to my second, which will explain the meaning of the sailing vessels in the fore-ground of the drawing, that are apparently issuing out of a canal lock. My intention in this was, to exhibit an easy, and obviously practicable mode, of transferring heavily laden vessels directly out of the water on to the rail-way, where they might be propelled by the wind with as much velocity as through the water; and at the same time to show how admirably Mr. Palmer's rail-way is adapted as a branch communication to, and from, canals and rivers, or to form an important connecting line between them.

"In cutting a canal, which has to proceed down a declivity, and to ascend another inclined plane, numerous locks must be constructed at an enormous expense, which cause great loss of time, and inconvenience in the traffic. This heavy expense and inconvenience would be completely obviated by the adoption of Mr. Palmer's rail-way—as a connecting communication.

"The vessels issuing from the lock, are supposed to have entered it from some river, or canal, (as at A in the ground plan of a lock.) The rail-way is constructed as usual, elevated upon pillars—and does not terminate on arrival at the lock gates, but passes over them, and terminates at the other end of the lock, just within the second gates,

and is supported on pillars from the bottom of the lock, the same as on dry ground. The double train of vessels having all entered the lock, half on one side the rail, and half on the other, they are hooked on to the axletrees of the wheels which are already upon the rail, prepared for that purpose. The gates next to the river, or canal, are then closed, and all being fast, the water is let out of the lock by a sluice, (shown in the drawing,) till it falls below the bottom of the outer gates, at which time the vessels are all suspended on their axles, in the air—the gates are opened, and they sail out across the valley;—or they are propelled by whatever other power may be eligible.

"*Description of the Plan of the Lock.*

"A is the end of a canal or cut from a river, with the lock gates adjoining. B is the exterior of the other end of the lock, over the whole length of which the rail-way extends; a portion of which is seen at B. On the rail-way are shown the edge view of the wheels, with the axletrees, which extend over the vessel, two to each vessel; the vessels are thus arranged, and hooked on to the axletrees, when the sluice D is opened, and the water let out, which leaves the vessels suspended."

Observations on Coppering Ships, and a description of the Method of Fastening a Ship's Side with the Iron Knees, invented by E. CAREY, *Inspecting Shipwright, and Surveyor of Shipping.*

ON observing one of my ships, after being coppered on the blocks in a dry dock, when floated out, I found that her copper under the buttocks, for a considerable way forward, and on the luff of the bows, for a great way aft, had become a great deal wrinkled or puckered; as this appeared very unsightly, and as I knew that the raised parts of the copper, from meeting with resistance, would soon be worn through, I gave the ship a careen, took the copper carefully off, had it beaten smooth, and put on again. The consequence was, that the copper remained smooth until I new coppered the same ship again.

I find that all ships drop forward and aft, more or less, according to their strength, when first launched off the stocks, or floated from a straight block, in a dry dock. I therefore now determined to sheath my ship up no higher than light water-mark, while in dock, on straight blocks, and, in two or three days after the ship had settled, to finish the coppering. I did so, and had the satisfaction to see my copper continue smooth to the last. This information may be worthy the notice of merchants and ship-owners.

Method of Fastening a Ship's Side with the newly-invented Iron Knees.

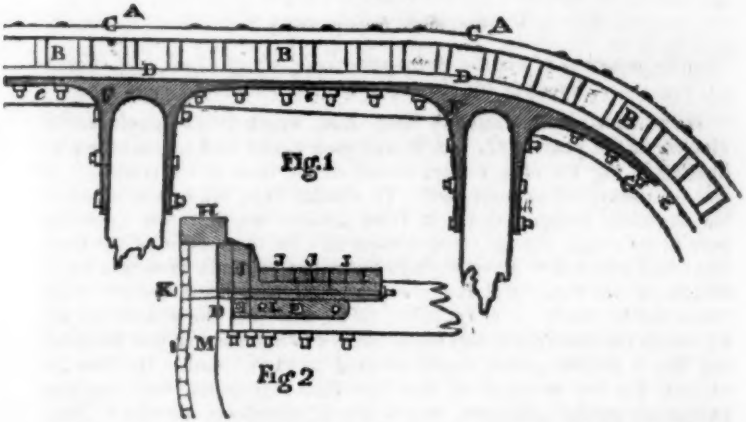


Fig. 1 is a horizontal section of a portion of a ship's side and beams.

A A shows the ship's side—B B B the timbers—C C the thickness of the outside planking—D D a plank, 3½ inches thick, which goes all round the ship, inside the timbers, against which the iron knees are fixed, and bolted through the side—*e e e* a horizontal clamp, 10 inches wide, and 6 inches thick—F F the iron knees, 4 inches wide, and 2 inches thick, which are bolted through the beams and ship's side, as at G G.

Fig. 2 is a vertical section of the same parts as fig. 1.

H is the plank-sheer—I the water-way—J J J the ends of the planks—K a bolt that goes through the ship's side, through the edge of the water-way, and six streaks of the deck, below the beam, and is clenched on an iron plate on the inner plank—L arm of the knee—M the ship's timber and side—D is an edge view of the inner plank, as shown at D, fig. 1.

The above is a rough sketch of my new-invented Iron Knee and water-ways, which are let down upon the beam 3 inches, and also six of the deck planks, and bolted through all; under the beam a plank 3½ inches thick is first brought on, inside the ship, against which the ends of the beam are fixed. The horizontal clamp, 10 inches wide and 6 thick, is then brought on under the edge of the plank, and bolted through the side. On this clamp the beam is dove-tailed in one inch down, and bolted through the end of the beam. A ship fastened in this way will render it impossible for the side to move; consequently no wet can possibly get down, and the ship must be kept perfectly dry and sound.

E. CAREY.

[*Register of Arts.*

Of Clock and Watch-making, and of the method of Dividing the Day at different periods of time.

[Continued from p. 248.]

Further progress of the theoretico-practical part of Clock and Watch-making till the end of the 18th century.

Huyghens, it has already been said, applied the pendulum to clocks, in the year 1657, but it was soon found that a pendulum vibrating in the arc of a circle, varied in the time of its vibration, as the arc decreased or increased. To obviate this, Huyghens invented the cycloidal plate; and De la Hire assures us, that this cycloidal pendulum clock, though often compared with the motion of the fixed stars, did not differ in eight days but a few seconds from the mean motion of the sun. But Huyghens himself soon found that the plate could not be made in a cycloidal form, and that the silken threads by which the pendulum was suspended did not answer the purpose, but that a pliable spring could be used in their stead. He then invented, for the purpose of more perfect regulation, that singular pendulum called *pirouette*, which has a cruciform motion. This, however, was also rejected. About the end of the 17th century, Derham and Hook conceived the idea of making the pendulum swing in small arches, and applying heavy lenticular weights. This method was adopted by Le Bon and De Rivaz at Paris, and by Clement in London, who also invented the, so called, English pallet.

Another difficulty to be overcome in regard to clocks and watches, was the influence which heat and cold have upon the expansion and contraction of metals, and which alters the motion of the whole. Graham is considered as the first who made experiments with a view of freeing the pendulum from such changes. He first conceived the idea of making pendulums of ebony, fir-wood, walnut-tree, &c.; but found that the moisture of the air produced other inconveniences. Experiments of the same kind were afterwards made by Magellan, Fontana, Ludlam, Schröter, Crostwaite, and Köhler. Graham next constructed a pendulum of an iron tube, which was filled to a certain height with quicksilver. Troughton, instead of an iron tube filled with quicksilver, employed one of glass, having at the end a bulb like the tube of a thermometer. But still happier was Graham's idea, to construct a pendulum of several rods of different metals, so combined, that the expansion of the one should be fully compensated by the contraction of the other; and this gave rise to the gridiron pendulum. Before Graham, however, Short, Cassini, and Ellicot had entertained a similar idea of a compound pendulum; and the plan of a gridiron pendulum was first carried into execution by Harrison in the year 1726. Besides the pendulum proposed by Graham and by Harrison, several other modifications of the same principle were applied by different persons, as by Berthoud, Grenier and Syffert. A lever pendulum was invented by Ellicot, and another by Grenier: the tubular pendulum was contrived by Rivaz, and the most simple

of all, the compensation pendulum, by Faggot, a Swede, about 1740, and which Schmidt, a watchmaker of Stettin, has lately employed with much ingenuity.

The highest degree of perfection, however, to which watch-making has attained, is in the construction of the nautical time-keepers, for the invention of which large premiums were offered in England, France, Holland, and Spain. Huyghens and Sulley made attempts for this purpose, but they were not attended with success; and the ingenious proposals of Leibnitz were not found sufficient. Harrison's first time-keeper, which he presented to the Royal Society in 1736, was regulated by balancing rods, placed crosswise over each other, with circular springs at the ends, which rested against two plates, which by the dilatation of the circular springs, in consequence of heat, separated, and on their contraction, by cold, approached each other. The friction also was lessened, and the time-keeper was suspended like the mariner's compass. In a voyage of twelve weeks, the error in going amounted only to 36 seconds. A second one, constructed in 1749, which was smaller and more convenient, surpassed the first. To a third, constructed in 1753, he applied a balance with a spiral spring, and a compensation rod of brass and steel. In 1761 he constructed a fourth, which, on a voyage of experiment that lasted 81 days, erred only 1 minute 54½ seconds. A fifth, finished in 1764, erred only 54 seconds in six weeks. Dr. Maskelyne, however, to whom it was afterwards referred for trial, did not give so favourable a report of it. Berthoud and Le Roy made attempts also to construct time-keepers; but the first were not successful. In the year 1741 Le Roy's time-keeper, which in six weeks erred only half a degree, was preferred to that of Berthoud, which in the same time erred 34 minutes 36 seconds. The time-keepers of Arnold, Rendai, and Mudge, were found to be exceedingly correct. Mudge constructed only three; the first of which was tried, in the year 1774, by Dr. Maskelyne, Hornsby, Count Bruhl, Von Zach, and Campbel. The other two were tried by Dr. Maskelyne in 1777. One of them, in the course of 93 days, was found to have exceeded the mean time by only 1 minute 1·8 second. It showed the longitude between London and Oxford within 1·6 second. The balance vibrated altogether independently of the wheel-work, and always received from the moving power a new impulse, which at each vibration was uniform. The balance had two spiral springs, which produced a very uniform action. Besides this, the machine was furnished with a compensation balance. In imitation of the nautical time-keepers, pocket chronometers were constructed. These serve for determining the geographical longitude on land. In these the free scapement of Mudge is employed. Emery, an artist from Neufchatel, made the first, which, after a passage of four weeks, gave the longitude of St. John's, Newfoundland, correct within six seconds. Another, constructed by Mudge, in a voyage of 14 weeks, erred only 17 seconds. Mudge never made but two pocket chronometers. Arnold made above 900, of various constructions. His chronometers of the best kind, with gold cases, cost 120 guineas, with silver cases, 100.

ACTIVE AND PASSIVE STRENGTH.

*Sec. II.—Passive Strength.**

[From Gregory's Mathematics for Practical Men.]

[CONCLUDED FROM P. 234.]

THE modulus of the elasticity of hempen fibres has not been ascertained. Their cohesion is, for every square inch of transverse section, 6,400 lb. The best mode of estimating the strength of a rope of hemp, is to multiply by 200 the square of its number of inches in girth, and the product will express in pounds, the practical strain it may be safely loaded with; for cables, multiply by 120, instead of 200. The ultimate strain is probably double this; as will appear from the following account of Du Hamel's experiments. If yarns of 180 yards long, be worked up into a rope of only 120 yards, it will lose one-fourth of its strength, the exterior fibres alone resisting the greatest part of the strain. The register cordage of the late Captain Huddart, exerts nearly the whole force of the strands, since they suffer a contraction of only the eighth part in the process of combining.

For the *utmost* strength that a rope will bear before it breaks, a good estimate will be found by taking *one-fifth of the square of the girth of the rope*, to express the tons it will carry. This is about double the rule for practice which we have just given, (art. 32;) and is, even, for an ulterior measure, too great for tarred cordage, which is always weaker than white.

The following experiments were made by Mons. Du Hamel, at Rochfort, August 8th, 1741, on cordage of 3 French inches circumference, made of the best Riga hemp.

	White.	Tarred.
Broke with strain of	4500 pounds.....	3400 pounds.
	4000	3300
	4800	3258
	August 25th, 1743.	
	4600	3500
	5000	3400
	5000	3400
	September 23d, 1746.	
	3880	3000
	4000	2700
	4200	2800

A parcel of white and tarred cordage was taken out of a quantity which had been made February 12, 1746.

It was laid up in the magazine, and comparisons were made from time to time, as—

* We have omitted a considerable portion of this section, as being much too abstruse for mechanics in general. The omitted portion relates principally to the strength of timber, a subject of vast importance, and to which we shall revert, after moulding it into a popular form.

	White bore.	Tarred.	Difference.
1746 April 14th	2645	2312	333
1747 May 18th	2762	2155	607
1747 October 21st	2710	2050	660
1748 June 19th	2575	1752	823
1748 October 2nd	2425	1837	588
1749 Sept. 25th	2917	1865	1052

M. Du Hamel says, that it is decided by experience, that white cordage, in continued service, is one-third more durable than tarred; secondly, it retains its force much longer while kept in store; thirdly, it resists the ordinary injuries of the weather one-fourth longer. These observations deserve the attention of practical men.

The metals differ more widely from each other in their elastic force and cohesive strength, than the several species of wood or vegetable fibres. Thus, the cohesion of fine steel is about 135,000 lb. for the square inch, while that of cast lead amounts only to about the hundred and thirtieth part, or 1800 lb.

According to the accurate experiments of Mr. George Rennie in 1817, the cohesive power of a rod, an inch square, of different metals, in pounds avoirdupois, with the corresponding length in feet, is as follows:

Cast Steel,	134,256 lb.	39,455 feet.
Swedish Malleable Iron,	72,064 lb.	19,740 feet.
English ditto,	55,872 lb.	16,938 feet.
Cast-Iron,	19,096 lb.	6,110 feet.
Cast Copper,	19,072 lb.	5,003 feet.
Yellow Brass,	17,958 lb.	5,180 feet.
Cast Tin,	4,736 lb.	1,496 feet.
Cast Lead,	1,824 lb.	348 feet.

It thus appears, as Professor Leslie remarks, that a vertical rod of lead 348 feet long, would be rent asunder by its own weight. The best steel has nearly twice the strength of English soft iron, and this again is about three times stronger than cast-iron. Copper and brass have almost the same cohesion as cast-iron. This tenacity is sometimes considerably augmented by hammering or wire-drawing, that of copper being thus nearly doubled, and that of lead according to Eytelwein, more than quadrupled. The consolidation is produced chiefly at the surface, and hence a slight notch with a file will materially weaken a hard metallic rod. English malleable iron has 7,550,000 feet for its modulus of elasticity, or the weight of 24,920,000 lb. on the square inch, while cast-iron has 5,895,000 feet and 18,421,000 lb. Of other metals, the modulus of elasticity is probably smaller, but has not yet been well ascertained.

The *longitudinal compression* which any column suffers, is at first equal to the dilatation occasioned by an equal and opposite strain, being in both cases proportional to the modulus of elasticity. But while the incumbent weight is increased, the power of resistance likewise augments, as long as the column withstands flexure. After it begins to bend, a lateral disruption soon takes place. A slender vertical prism, is hence capable of supporting less pressure than the

tension which it can bear. Thus, a cubic inch of English oak was crushed only by the load of 3860 lb., but a bar of an inch square and 5 inches high gave way under the weight of 2572 lb. It would evidently have been still feebler if it had been longer. On the other hand, if the breadth of a column be considerable, in proportion to its height, it will sustain a greater pressure than its cohesive power. Thus, though the cohesion of a rod of cast-iron of the quarter of an inch square, is only 300 lb., a cube of that dimension will require 1440 lb. to crush it.

In general, while the resisting mass preserves its erect form, the several sections are compressed and extended by additional weight, and their repellent particles are not only brought nearer, but multiplied. This repulsion is likewise increased by the lateral action arising from the confined ring of detrusion. The primary resistance becomes hence, greatly augmented in the progress of loading the pillar.

The most precise experiments on this subject seem to be those of Mr. Rennie. The weights required to crush cubes of the quarter of an inch of certain metals, are as follow:

Iron cast vertically,	11,140 lb.
Iron cast horizontally,	10,110 lb.
Cast Copper,	7,318 lb.
Cast Tin,	966 lb.
Cast Lead,	483 lb.

Cubes of an inch are crushed by the weights annexed:

Elm,	1,284 lb.
White Deal,	1,928 lb.
English Oak,	3,860 lb.
Craigleith freestone,	8,688 lb.

Cubes of an inch and a half, and consequently presenting a section of $2\frac{1}{4}$ times greater than the former, might be expected to resist compression in that ratio. They are crushed, however, with loads considerably less.

Red brick,	1,817 lb.
Yellow baked brick,	2,254 lb.
Fire brick,	3,864 lb.
Craigleith stone, direction of the strata,	15,560 lb.
Ditto, across the strata,	12,346 lb.
White Statuary Marble,	13,632 lb.
White-veined Italian Marble,	21,783 lb.
Purbeck Limestone,	20,610 lb.
Cornish Granite,	14,302 lb.
Peterhead Granite,	18,636 lb.
Aberdeen Blue Granite,	24,536 lb.

These facts show the comparative firmness of different materials, but it is to be regretted, that such results are not of much practical value, since they are confined to a very narrow scale, and applicable only to cubical blocks. While the breadth remains the same, the resistance appears to depend on some unascertained ratio of the altitude of the column.

Nay, as Professor Leslie observes, the absolute height itself has probably, a material influence on the effect. Thus, from some experiments made in France, it appears, that prisms of seasoned oak, two inches square, and two, four, or six feet high, would be crushed by the vertical pressures of 17,500 lb., 10,500 lb., and 7,000 lb.; but, if four inches square, and of the same altitudes, they would give way under loads of only 80,000 lb., 70,000 lb., and 50,000 lb. In the first set of trials, the mean cohesive power amounts to 130,000 lb., and in the second, to 520,000 lb. The vertical support is, therefore, greatly inferior to these limits. When the length of the pillar exceeds 36 times its breadth, the resistance to longitudinal compression appears to be diminished 18 times.—[*Leslie's Elements*, and *Duhamel in Mem. Paris. Acad.*

Mr. B. Bevan has favoured the author with a tabular view of his results with regard to the *modulus of cohesion*, or the length in feet of any prismatic substance required to break its cohesion, or tear it asunder.

Bevan's Results.

	Feet.
Tanned cow's skin,	10,250
——— calf skin,	5,050
——— horse skin,	7,000
——— cordovan,	3,720
——— sheep skin,	5,600
Untanned horse skin,	8,900
Old harness of 30 years,	5,000
Hempen twine,	75,000
Catgut, some years old,	23,000
Garden matting,	27,000
Writing-paper, foolscap,	8,000
Brown wrapping-paper, thin,	6,700
Bent grass, (holcus,)	79,000
Whalebone,	14,000
Bricks, (Fenny Stratford,)	970
——— (Leighton,)	144
Ice,	300
Leicestershire slate,	7,300

On Blowing Air into Furnaces by a Fall of Water. By the late William Lewis, M. D.

[Continued from p. 241.]

EXPERIMENTS AND OBSERVATIONS FOR THE IMPROVEMENT OF THE FOREGOING MACHINES, AND FOR ESTABLISHING THEIR PRINCIPLES OF ACTION.

I. *Of the quantity of water they require, and the quantity or force of the air they afford.*—The quantity of water may be estimated with sufficient exactness from the height of the water in the funnel or basin at the top, and from the ~~width~~ area of the choak or throat of the

funnel, through which it is pressed by the force of a column of that height.

Desaguliers found, by an experiment often repeated, that the quantity of water running through a square inch hole, twenty-five inches under the surface, is five tons and a fifth in an hour, the ton containing two hundred and fifty-two gallons. The quantities discharged through equal holes at different depths, being as the square roots of the depths, and the quantities through different holes, at equal depths, being as the areas of the holes, it will appear, on calculation, that in the machine at Lead-hills, whose funnel is five feet high, and its throat three inches and a half in diameter, the expense of water is somewhat more than seventy-seven tons in an hour, or near three hundred and twenty-four gallons in a minute; and that in the machine of Dauphiny, where the height of water in the funnel is only about half as great, and the bore of the throat a little wider, the quantity of water is about two hundred and sixty-six gallons in a minute. Perhaps the real quantity of water may be somewhat less than this calculation given, as the resistance of the compressed air may occasion some retardation of the motion. Of the other machines, the descriptions are too imperfect or obscure for any computation to be made from them.

The water issuing from the narrow throat of the funnel with great velocity, is said to spread so as to fill the wider bore of the pipe, and to become frothy, from the mixture of air with it. The jet, thus enlarged, may be conceived as consisting of a multitude of slender streams or drops, the intervals between them being occupied by air, which is continually supplied through the air-holes, and pushed down by the succeeding drops or streams. It has therefore been reckoned, that the volume of air which passes down the pipe, must be as much greater than that of the water, as the transverse area of the jet, when spread and reduced to drops in the pipe, is greater than when it passed through the throat of the funnel. Circles being to one another as the squares of their diameters, the area of the pipe of the Lead-hills' machine will be to that of the funnel's throat, as eighteen to twelve and a quarter: the volume of air, according to the above principle, being to that of the water in the same proportion, and the quantity of water nearly 324 gallons in a minute; the quantity of air in a minute should be about 475 gallons and a half, or 134,000 cubic inches, or 176 cubic feet of air in a minute: so that, by this way of reckoning, the Dauphiny machine, with nearly a fourth less water than that of Lead-hills, should produce more than a double quantity of air.

But though this method of computation appears specious, it is not, perhaps, to be much depended on; air, in different circumstances, occupying very different volumes, in virtue of its great compressibility; nor is it certain that the bores of pipes are sufficiently filled, so as to carry down the full quantity of air. It may be presumed that the air, intermingled in the jet, is always in some degree compressed by the water, so that the interstices between the streams or drops contain more air than equal spaces of the atmosphere. It

may be judged, however, from the above comparison, that the wider the pipe is, in proportion to the funnel's throat, provided the water running through the throat will spread through the whole extent of the bore of the pipe, the more air will be carried down.

M. Barthès, the only person I know of who has examined these machines philosophically, and endeavoured to improve them, gives a method, in the memoir above quoted, of comparing the proportional quantities or forces of the air, in different blowing machines, on another principle. From considerations, too abstracted to be here particularized, he deduces a general rule, that the produce of air will be, in all cases, in proportion to the quantity and velocity of the water: so that the quantity of water and height of the fall being given in two machines, and the volume or force of the air in one of them being measured by experiment, the volume or force of air in the other may be determined by the rule. Accordingly, he made several experiments of this kind, in two machines; measuring the force of the air, when the water in the basin was at different heights, by the weight which the blast, acting on the arm of a balance, was capable of raising. Taking one of these experiments for a standard, he computed by the rule, what the results of the others ought to have been; but the experiments and calculations ill agreed together. And, indeed, the rule does not seem to be applicable, but in circumstances which can scarcely be expected to occur; for it supposes the machines to be all perfect, and every drop of the water to have its utmost effect, or to carry down with it as much air as it is capable of doing, which cannot be admitted to be the case in any of the blowing machines yet constructed.

In the "*Art des Forges*," are mentioned some observations of Reaumur, of the quantity of air afforded by the wooden bellows. He finds that those used at the iron furnaces yield 98,280 cubic inches, or upwards of five cubic feet of air, at every stroke; and, including the two bellows which act alternately, 240 strokes in a quarter of an hour; which, on a reduction of the French measures to the English, make 1,301,896 cubic inches, or upwards of 753 cubic feet in a minute: this quantity exceeds that which the foregoing calculation gives, for the machines of Dauphiny, above four times; and, therefore, four of the machines should scarcely be able to supply the iron furnace with so much air as the wooden bellows do; whereas two or three are said to be sufficient. Again, the bellows of the iron finery and forge were found to give two thousand and fifty-one cubic inches and a third, at each stroke, and four hundred and twelve strokes in a quarter of an hour; whence the quantity of air in a minute is 458,247 cubic inches, or somewhat more than 265 cubic feet; this is greater than the calculation of the water machine, in the proportion of about three to two, though one of the water machines is found to supply the office of the bellows.

It is not to be supposed that the quantity of air which furnaces require, is confined to any such precise limits, as that two bellows, from their being found to answer sufficiently for one kind of furnace, or even two for one individual furnace, can be concluded to yield

quantities of air exactly or nearly equal. The above differences are, perhaps, as little as can be expected in comparisons of this kind, where the effects compared are so indeterminate.

As to the water machines, it is plain that the quantity of air carried down cannot be greater than the spaces between the drops, or divided streams in the pipe, can contain; and that, though the air in these spaces must be considered as being compressed to a certain degree, yet it cannot be supposed compressed into two-thirds of its natural volume, which would be necessary for making the calculation of the wooden bellows and the blowing machine to agree; because such a condensation would require the weight of a column of water of eleven or twelve feet, or the third part of such a column, as is equivalent to the pressure of the atmosphere; whereas, in the Dauphiny machine, though the air was pressed down with the full force of the column of water above the choak, their height is less than three feet, and could not condense it more than one-twelfth part.

In what manner Reaumur computed the air of the wooden bellows, we have no account; it is probable that he judged, as others have done in the same cases, from their capacity; supposing the whole quantity of air they contained to be delivered at every stroke. If so, we can lay no stress on the computation, for neither the wooden nor the leathern bellows, deliver their full contents of air; a considerable space remaining full of air, when the bellows are closed; and this space containing considerably more air than an equal volume of the atmosphere, on account of the air being condensed in them by the pressure of the bellows. I have been informed by a judicious workman, that the bellows of the iron finery retain commonly a third, and sometimes half of their air; and that when lined with wood, so that as little vacant space as possible might be left, he found them to blow much stronger than before.

The strength of the bellows is best judged from the force of the blast itself, and this force may be determined in the method recommended by M. Barthès, already mentioned, by the weight it is capable of raising. He found that in the blowing machine of St. Pierre, the force of the blast issuing from a hole of an inch and a third in diameter, raised the arm of a balance loaded with a weight of twenty-five ounces and a half. He gives some other experiments of comparing the proportionate diminution of its force, according to the diminution of the height of the water, which I shall insert in the original French measures, to avoid unnecessary fractions. The above force of twenty-five ounces and a half, is the maximum of this machine, produced by the full quantity of water in the basin, or a height of forty-eight inches above the choak: with a height of forty-one inches, the weight raised was twenty-two ounces; with a height of thirty-two inches, nineteen ounces; with a height of twenty-eight inches and a half, seventeen ounces and a quarter; with twenty-four inches and a half, fifteen ounces and a quarter; with nineteen inches, twelve ounces and three-eighths; with sixteen inches and two-thirds, ten ounces and a quarter; and with a height of thirteen inches and a half, eight ounces and three-quarters.

It may be observed, that in some of these experiments the water must have been employed to disadvantage; and that, by increasing the height of the water much further than the above limits, in the same machine, we could not expect to produce proportionate augmentations of the force of the blast: for if a certain quantity of water, running with a certain velocity through the choak, be supposed to fill the bore of the pipe, a less quantity, with a less velocity, must leave a vacancy, which will suffer part of the air to escape; and a greater quantity, with a greater velocity, must have some part of it spent ineffectually, for want of sufficient room to spread. Some experiments, to be mentioned hereafter, afford a clear proof of this.

[TO BE CONTINUED.]

ENGLISH PATENTS.

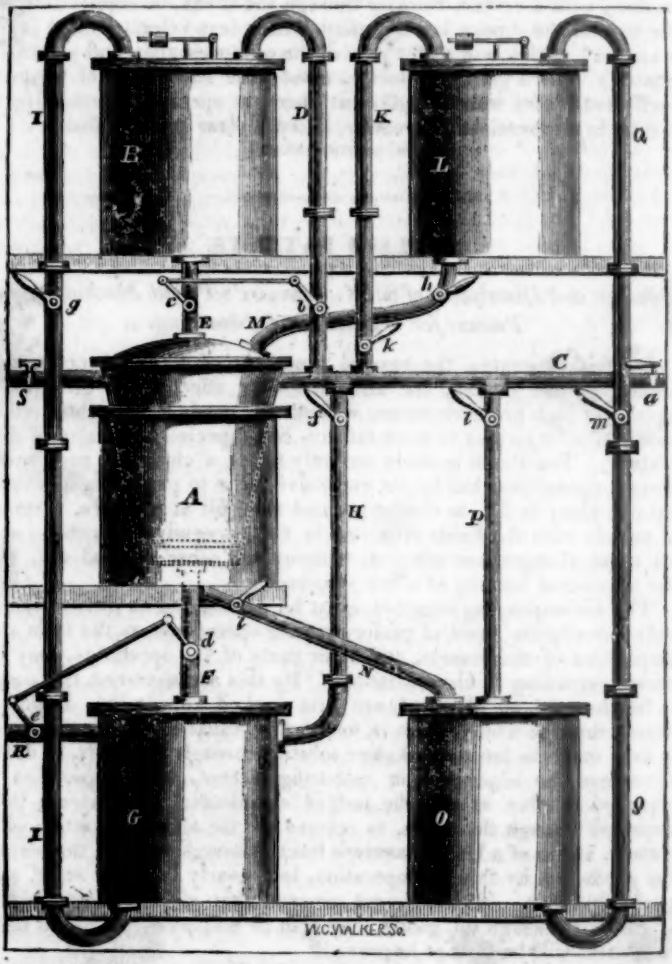
Account and Description of S. W. WRIGHT'S *Patent Machinery, and Process for Washing and Bleaching.*

BY this apparatus, the several processes of washing, cleansing, bleaching, and drying, are almost wholly effected by the simple agency of high pressure steam, without the goods being submitted to *rubbing*, so injurious to most fabrics, but especially to those of fine texture. The steam is made not only to act a chemical part in the several operations, but by its expansive force to perform a mechanical one also; to fill, to discharge, and to re-fill at pleasure, a series of vessels with the fluids required in the successive processes; and all these changes are effected, without any other manual aid, but the occasional turning of a few stop-cocks.

The accompanying diagram, must be considered as illustrative of only one eligible mode of performing the operations, as the form and disposition of the vessels, and other parts of the apparatus, may be varied according to circumstances. By this arrangement, the goods to be cleansed, or bleached, are first packed closely into a conical vessel, through which steam is, for a while, caused to pass; the steam is next made to force an alkaline solution through the goods, in order to remove the impurities, or colouring matter, (which operation is repeated as often as may be judged expedient;) hot water is then impelled through the goods, to remove all the alkaline matter; ultimately, steam of a high pressure is forced through to expel the water; the goods are, by this last operation, left nearly in a dry state, and perfectly clean. A subsequent process, that of introducing blasts of cold air through the goods, may also be employed, by which their whiteness will be further improved.

A, is a copper vessel, formed as the frustrum of a cone, at the lower part of which is a perforated false bottom or grating, and below this, the real bottom, from whence a pipe descends. The cotton, linen, or other articles to be operated upon, having been previously soaked in water and rubbed over with soap, are to be closely

packed in this vessel, the lid of which is then to be screwed down and rendered steam tight at the junction. In the diagram, this conical vessel is shown, surrounded by a jacket, to prevent the radiation of the heat, but this addition, the patentee does not consider to be absolutely necessary. B is a vessel (which is also of copper, as well



as the other vessels and tubes represented,) containing soap and water, or the usual alkaline solutions of pearl-ash, soda, &c.; C is a pipe leading from a steam boiler, through which is introduced steam, that has been raised to a pressure of 50 lbs. upon the inch, which is at first to be gradually admitted into the apparatus, by partially

opening the stop-cock, *a*, when it passes into the vessel A, where it is allowed to act upon the goods therein deposited, for half an hour; after which, the cock *a* may be completely opened, and the full force of the steam be allowed to operate, first, opening the cocks *b*, *c*, *d*, *e*, when the steam will pass up the pipe D, into the vessel B, containing the alkaline solution. The pressure of the steam upon the surface of the liquid in this vessel, will now cause it to descend through the pipe E, into the vessel A, and herein, the steam continuing to press, will force the alkaline liquid through the goods, saturating every part, and carrying dirt and other impurities to the bottom, the liquid passing off through the pipe F, into the receiver G, underneath.

The pressure of steam is next employed to re-fill the vessel B, with the discharged alkaline liquor; for this purpose, the cocks, *b*, *c*, *d*, *e*, are to be closed, and the cocks *f* and *g* to be opened; the steam will now pass down the pipe H, and operate with its full pressure upon G, thereby forcing the liquid up the pipe I I, again into B; from whence it is forced again through the goods in the vessel A, repeating the operation as often as it may be found necessary, in order to perfectly cleanse them; the number of times it will require, will depend upon their degree of foulness, &c. which can only be determined by experience: for the ordinary washing of body linen, twenty times have been found sufficient.

Having now removed all the dirt and other impurities from the articles operated upon, the next process is that of rinsing, which is effected by closing the cocks, *b*, *c*, *d*, *e*, *f*, *g*, and opening those at *i*, *k*, and *h*, when the steam from C, passes up the pipe K, into the vessel L, which is filled with clean hot water; the full pressure of the steam being now transferred to the surface of the hot water, forces it through the pipe M, and through the goods in the conical vessel A, carrying away the alkaline and other impurities through the pipe N, into the vessel O. The hot liquor in O, is now to be returned into L, by *i*, *k*, *h*, and opening those at *l* and *m*, when the steam passes down the pipe P, and forces the liquor contained in O, up the pipe Q Q, again into L, for the renewal of the operation, this part of the process being also repeated as often as may be deemed desirable, which will depend upon the condition of the goods.

The washing and rinsing having been performed, drying forms the next part of the process, which is effected by closing all the cocks except those at *a d e*, and allowing steam at a reduced pressure to pass direct from *c* into the vessel A again, by which all the water is driven out from the goods, leaving them in nearly a dry state, the steam passing off through the pipe F, and escaping at R. In this part of the process it is necessary to observe that steam should not be employed at a greater pressure than 20 lbs. to the inch, and that its action should not be prolonged beyond the time required for driving off the water.

For the bleaching of piece goods, in lieu of the circular-sided vessel A, the patentee recommends one with straight sides, with its area diminishing downwards: in this vessel the goods, having been

carefully folded, are to be packed closely together, and, in addition to the steaming and washing by means of alkaline solutions, currents of cold air, produced by a blowing machine, are to be admitted through the pipe S, which it is said greatly assists in whitening the fabric. [*Register of Arts.*

Description of the Diving Apparatus, patented by W. H. JAMES, ESQ.

A VERY ingenious attempt has been made by Mr. W. H. James, to construct a diving apparatus that will enable the wearer to descend to the bottom of deep water, and remain there for half an hour, or more, to execute a variety of important operations, altogether impracticable without it: such as the recovery of sunken property; the obtaining of coral and pearls; building under water, &c. For some of these purposes the diving bell has of late years been employed, but as the workmen who descend can only carry on their work within its narrow limits, their operations are very much restricted. To overcome this inconvenience and give a more extended range to the actions of the diver, so as to render them more effective and useful, has been the object of Mr. James, in his invention, which has recently become the subject of patent right.

The diver is attired with a portable vessel, (placed around and adapted to the figure of his body,) which is filled with condensed atmospheric air, and by means of a simple arrangement of pipes and judiciously constructed valves, he is enabled to supply himself with fresh air for respiration during the time he is under the water.

It must be obvious that an apparatus on these principles will admit of considerable variations in the construction, which have therefore been contemplated by the patentee in his specification; we restrict the description to one of the forms, and its mode of operation.

The accompanying engraving gives a front view of the diver, fully equipped with the apparatus, and represents him as engaged in recovering from a wreck, at the bottom of the sea.

A is the vessel to contain the condensed air, which is to be filled by means of a condensing air pump; it consists of a series of strong metallic tubes, or one continuous tube, coiled elliptically round the body, and connected together by bands, to which straps are attached to secure it in its position. At *a* is a valve opening inwardly, through which the air is to be forced by a condensing pump, until it has acquired the desired degree of density; or the vessel may be filled, by attaching to the valve *a*, a reservoir already filled with condensed air, and allowing it to flow through the same until the pressure becomes equalised. The degree of density required will of course be determined by the time it is proposed for the diver to remain under water. (With a vessel of the magnitude exhibited, thirty atmospheres are considered sufficient for an hour's consumption.) B is a tube made of caoutchouc (or Indian-rubber) for conveying the air into the water-tight helmet C, by means of a valve so contrived as to be under the complete and easy control of the diver. The helmet

may be made of any water-tight material, but thin copper is recommended; it is provided with a strong plate of glass in front to enable the diver to see surrounding objects. Inside the helmet is a flexible tube *c*, with a mouth-piece at the end, which comes near to the mouth of the diver; through this the air is discharged from his lungs, which passes out of the valve *d*, shown in the upper part of the helmet. At the lower part of the helmet and round the breast, back, and shoulder, a water-proof garment *e* is attached, fitting closely round the body of the wearer, and made fast by elastic bandages *f*. To secure the diver from being inconvenienced by the pressure of the air within the helmet becoming too great, a safety valve is inserted about the breast to allow the desired portion to escape.

The weight of the apparatus may amount to about 50 lbs., but as this will not be found sufficient to give stability to the diver, weights

must be attached to the lower parts of the apparatus, two of which are represented in the drawing.

The patentee likewise contemplates the employment of the same apparatus, *divested of the weights*, in mines and other places filled with deleterious gases, wherein it may be used with perfect safety, and great advantage.

Description of a Machine for Hulling Rice, invented in the United States, and patented in England, by MELVIL WILSON, *agent of the invention. Enrolled, June,* 1827.

THE apparatus by which the natives in most countries, where rice is grown, deprive the grain of its husk, is so rude and ineffective, that it is a matter of surprise the experience and wants of society have not, until lately, caused the introduction of contrivances better calculated for the purpose. A machine for effecting this operation must necessarily be very simple, as the act required consists merely in rubbing the grains against one another, or in contact with some other substance. Of these two modes, the latter is attended with the disadvantage of causing a deposition of small particles from the foreign substance (detached from it by collision) upon the grain; to remove which an additional operation becomes necessary, or the rice would not be proper for food. The inconvenience just stated, has, we know, resulted from an attempt to clean rice in the manner that many articles of manufacture are cleansed, viz. by turning the grain round in a barrel fixed upon a revolving axis, in which was also deposited a quantity of pebbles; the husking was, however, thus quickly accomplished, and the pebbles were separated with facility by throwing them upon a sieve, the meshes of which were adapted to let only the rice pass through, and to detain the stones.

To conduct the operation of husking simply by the collision of the grains of rice against one another, has not only the advantage of *superior cleanliness*, but, we think, also that of *greater expedition*. On this principle is constructed the machine we have to describe, which is the invention of a foreigner residing at New York, and has been patented in this country by Mr. Wilson, as the commercial agent of the inventor. The enrolled specification of this patent is very concise, and describes merely a portion of the machine, as represented on the other side of the page, the additions being made by us to render the apparatus more complete, and worthy of adoption in the Colonies, not doubting that the patentee will be disposed to grant licenses for the use of that portion of the apparatus claimed by him as original; and, as respects our additions, they are free gifts to whomsoever they may be useful.

The patented portion consists of a long hollow cylinder of metal or wood; around the interior surface of which are fixed, at equal distances and in parallel circles, a series of angular bars, projecting towards the centre or axis of the cylinder; this cylinder revolves loosely on a central shaft, which passes through it, and is provided

with a similar number of bars, pointing (as radii) from the centre to the circumference, and passing alternately between the bars in the cylinder, so as to leave, when at their nearest proximity, (or in opposition) an inch free space between them. Thus disposed, the cylinder is placed in an inclined position, the rice is allowed to enter it at the top, while the cylinder is made to revolve with a "slow motion" *in one direction*, the axis moving at the same time at "a high speed," and *in a contrary direction;* consequently, as the rice passes through the cylinder, the grain will be considerably agitated and turned about; and, by that means, the husks will be *rubbed* off before passing out at the lower end of the cylinder.

To render the construction of the interior of the cylinder perfectly understood, we have annexed the diagrams in the margin.

Fig. 1 represents a plan of the cap of the cylinder, not fixed thereto, nor to the axis, which passes through it, but to the framing which supports the hopper; it serves therefore to guide the grain into the cylinder, and to keep out dirt and other adventitious substances.

Fig. 2 is called, in the specification, "a socket wheel;" it is fixed directly under the cap to the cylinder, and the axis passes through the socket, which serves, therefore, as a bearing for both the axis and the cylinder, permitting them to revolve freely in contrary directions. For the convenience of removal, this wheel is made to divide in two parts, as shown, which are bolted together when in use.

Fig. 3 gives a transverse section of the cylinder and axis, each of which being shown as provided with four bars, that number being fixed in each parallel circle, and alternately as respects those on the cylinder and those on the axis. This section likewise shows the cylinder as made of wood (with hoops round it) and that it is composed of eight distinct pieces or segments; on each of the eight segments is fixed a longitudinal row of similar bars, though only four (the number in one circle) are brought into view to prevent confusion.

Fig. 4 is a transverse section of one of the before mentioned bars, showing that they are of the figure of a quadrangular prism, that shape being preferred by the patentee for the purpose in question.

Fig. 5 is a plan of the bottom of the cylinder; it is formed in part like the socket wheel, described in Fig. 2, but the spaces between the spokes are closed; in each of these compartments a large aperture is made for the egression of the grain, which is regulated at pleasure by sliding doors to each, as represented.

The specification states, that the cylinder may be worked in either a vertical, an inclined, or a horizontal position, and with that view the sketches attached to it (the specification) are apparently design-

ed to exhibit a method of altering the position at pleasure:* the upper extremity of the axis of motion appears (by dotted lines) to be resting on a pivot beam, and to the lower extremity is a regulating screw, by which that end may be elevated or depressed at pleasure; the question of the best position of the cylinder is, however, decided by the patentee himself, who prefers it at an inclination of about 45°: we have accordingly thus placed it in our drawing, with the omission of the apparatus for altering its position.

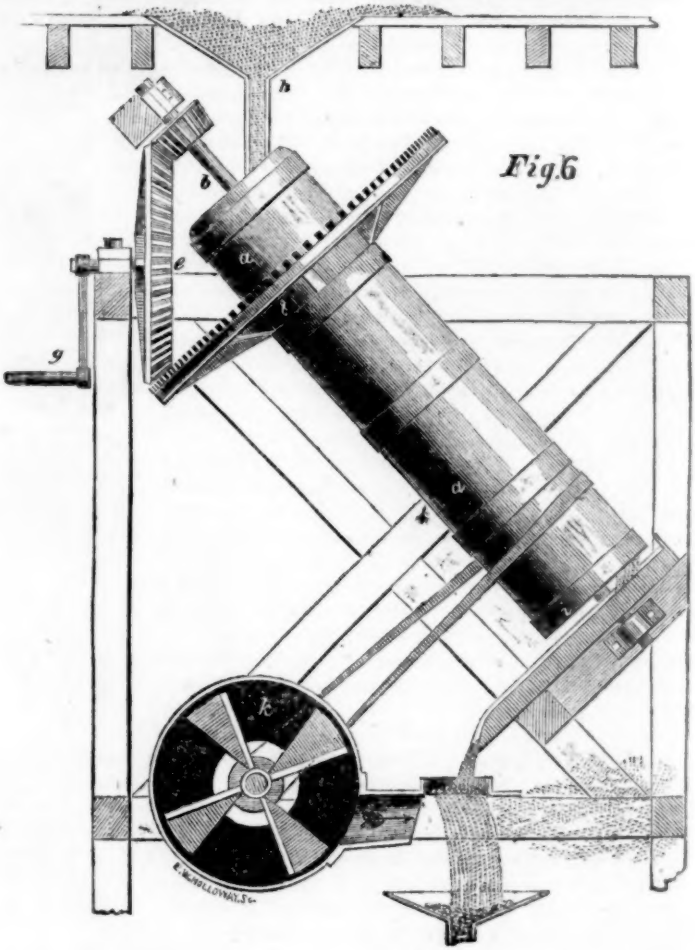


Fig.6

* If the alterations in the position of the cylinder be designed to accelerate or retard the passing through of the rice, that object is effected by enlarging or decreasing the apertures at bottom, by the sliding doors, as before mentioned.

No gearing for communicating motion to the cylinder and axis is either shown in the sketches, or described in the specification; we have therefore taken the liberty of placing such as appeared to us the best calculated to effect the motion intended, by the simplest means, and in the least compass; we are aware that the combination of the two wheels and pinion shown, is peculiar, perhaps never before proposed or attempted; nevertheless, we are convinced that they will, properly constructed, perform well.

At Fig. 6 the machine is shown complete.—*a a* is the husking cylinder; *b* the axis, turning in plummer blocks at *c c;* on the axis, *b*, is fixed a slightly-bevelled pinion, *d;* at *e* is a bevelled wheel, and at *f* a faced wheel. Motion being given to the winch, *g*, by manual force (or other power,) a "high speed" is thereby communicated to the shaft in one direction, and a "slow motion" to the cylinder in a contrary direction: during which the rice from the hopper *h* (shown in section) is continually pouring into the top of the cylinder, and as fast as it is husked, running out at the bottom, *i*. Here ends the process as described in the specification, but we have thought it not amiss to propose separating the husks or chaff from the rice as it runs out of the cylinder; accordingly, we suggest the addition of a blast cylinder or winnow, at *k*, which may be actuated by a band passing round the cylinder, *a*, or round a pulley at the back of the bevelled wheel, *e;* the husks may thus be completely separated from the grain at a single operation, in one connected machine, by a very slight increase of power, instead of two operations with distinct apparatus.

[*Ib.*

Account of the Apparatus for cleaning paddy, or rough Rice, Patented by MESSRS. LUCAS *and* EWBANK. Enrolled, May, 1827.

THE specification of this patent states, that it is for improvements upon a patent, granted in the year 1819, for the same purpose, to Mr. Ewbank, one of the parties in the present grant, which consists in some slight variations from the former process; found, nevertheless, to be essential to the perfection of the operations, and a more economical mode of preparing the rice for market.

The specification of the present patent, briefly recites the process described under the former, by which the improvements subsequently made, will be better understood; it consisted as follows:

The rough rice, or paddy, was first cleansed from dirt and other foreign matter, by passing it over a screen, which, detaining the rice, allowed the impurities to pass through. The paddy in this state was taken to mill-stones, set at a proper distance apart, to rub off the external shells or husks; the husks are next blown away by a fanning machine; the rice thus partially cleaned, is then deposited in mortars, where it is beaten and triturated for depriving it of the thin under pellicle, or red skin; and when the trituration has been carried far enough, the contents of the mortars are sifted upon a "slop-

ing and revolving screen," which is composed of three distinct wire cloths, of different degrees of fineness. The finest under cloth, allows the dust or flour to pass through, but detains the broken rice; the second or middle cloth, separates the broken, and detains the whole rice, while the coarsest upper cloth, allows only the whole rice, or husked grain, to pass through, and detains the unhusked, which is taken back to the mill-stones, to be operated upon again. The rice, still but imperfectly clean, was afterwards taken to the polishing and whitening machine, which consists of two cylinders placed concentrically; the exterior cylinder was fixed or stationary, and the interior one, which was made to revolve, was covered with sheep skins, with the wool on, and stretched upon boards or other proper framing, with the wool on the outside. Between these two cylinders the rice was put, and the inner cylinder being made to revolve, (by the action of a steam engine or other prime mover,) the rice was brushed by the constant friction of the wool, and thereby polished and whitened; in other words, brought to a state fitted for the market.

The foregoing, comprise the substance of the processes described in Mr. Ewbank's specification of the patent of 1819. The second patent, granted jointly to Messrs. Lucas and Ewbank, in May, 1827, relates to certain improvements upon the former, and is confined to a superior method of treating the rice, after it has been deprived of the external shell or husk by the operation already described, or by any other mode. This improvement is founded upon the observation, that the thin under pellicle of a reddish colour, which remains upon the grain after it has been shelled, is of a glutinous or gummy nature, and that the beating and triturating it in the mortars, occasioned the mass to become very sticky, and difficult to operate upon, towards the close of the process; and, that that portion of the rice which had already been stripped of its red pellicle, became injured in its colour, by continuing the process until the remainder in the mass had also been deprived of their red pellicles. To avoid this inconvenience, Messrs. Lucas and Ewbank now use successively, two or more sets of mortars, for conducting the last mentioned operation, in this manner: when the gummy or glutinous matter begins to disengage itself, (which is immediately manifested by the rice moving sluggishly under the pestles,) it is to be taken out of the first set of mortars, and carried to a second set, wherein is to be mixed with the rice, a quantity of the external husks well dried, in the proportion of one-fourth or two-fifths in bulk to that of the rice. The triturating and beating process is then renewed upon this mixture, the dry husks greatly assisting in cleaning and whitening the grain. After this, the mass is to be fanned and screened, to separate the refuse, when the rice is taken to the polishing machine as before described, which terminates the process. The fanning and screening is to be done as often as may be found necessary, between each triturating process, which may extend to three or four distinct operations, according to the quality or state of the rice.

The patentees observe in their specification, that they consider the

stickiness of the rice to be owing to the humidity of the climate of this country, or to a certain dampness which it acquires in its voyage, as the difficulty they experience, has not been noticed in the rice mills employed in the Carolinas and elsewhere.

[*Ib.*

Account of the Process invented by J. G. CHRIST, *for Enamelling Cards, and for which he has obtained a Patent.*

THE process for manufacturing these beautifully white enamelled cards is as follows:

One pound of parchment cuttings, a quarter of a pound of isinglass, and a quarter of a pound of gum arabic, are to be boiled in an iron pot, or other vessel, in 24 quarts of pure water, until the solution is reduced to 12 quarts, when it is to be taken off the fire and strained, clear. The solution, of this consistence, is then to be divided into three equal portions of four quarts each; to the first of these portions is to be added 10 pounds of *pure* white lead, (previously ground fine in water,) which is called *Mixture No.* 1; to the second portion, 8 pounds of pure white lead, forming *Mixture No.* 2; and to the third is to be added 6 pounds of pure white lead, making *Mixture No.* 3. The sheets of paper are then to be stretched out flat upon boards, and brushed over with a thin coat of No. 1 mixture, with a common painter's brush; the paper is then to be hung up to dry for 24 hours: after this, the paper is in a similar manner to receive a coat of No. 2 mixture, and dried again for 24 hours; the paper is then to undergo the same process with No. 3 mixture, and dried for 24 hours more. It is now to be printed with the engraved plate, and the press board used for the purpose is directed to be of smooth cast-iron, instead of wood. The printing being completed, the paper is to be hung up a fourth time for 24 hours, to dry; after this, it undergoes the final operation of receiving its high gloss, which consists in laying the work with its face downwards on a highly-polished steel plate, and then passing both together, with great pressure, between a pair of cylindrical rollers: and thus the beautifully polished surface of the steel is transferred to the composition on the paper, which closely resembles the finest white enamel.

It is to be regretted, that this enamelled surface is not very durable, as it comes off after wetting it slightly with the finger. A considerable competition in the preparation of enamelled paper, or cards, has been excited among the manufacturers, by the eminent success which has attended Mr. Christ's career, in the undertaking: former processes for producing similar effects have been renewed and encouraged by the trade; and we have particularly noticed that the cards sent out by Messrs. Shaw and Sons, of Fetter Lane,—and Mr. Alfred Storer, of Pentonville,—while they possess the high polish of Mr. Christ's manufacture, will sustain bending without cracking, and retain their polish after being wetted. [*Ib.*

Description of a Patent Air Engine, invented by ROBERT *and* JAMES STIRLING, *of Glasgow.* Enrolled, July 20, 1827.

ALTHOUGH it is well known that the elastic force of fluids, generally, is increased by an increase of temperature, yet, very few attempts have been made to render available this increased elastic force, in any fluid except water, the vapour of which has long occupied the attention of the ablest engineers; hence the numerous improvements and modifications of steam engines, which have been applied to produce motion in machinery. Still, however, a few plans have been proposed for applying the elastic force of air and other fluids, and we have now the pleasure of laying before the public, a description of Messrs. Stirlings' air engine for this purpose.

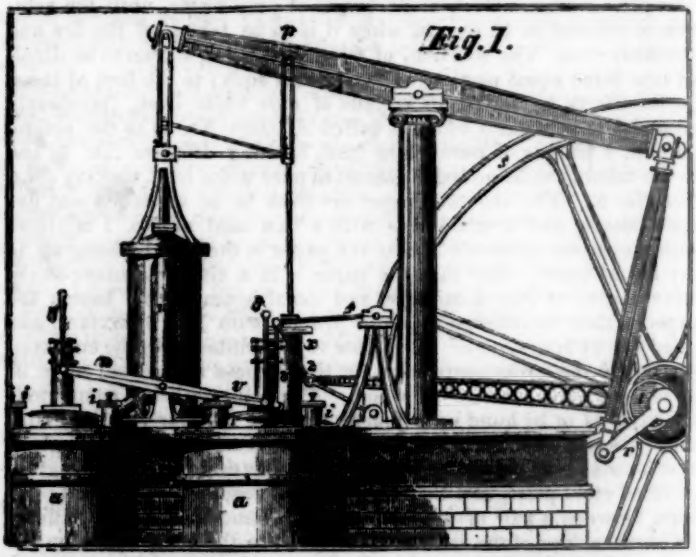


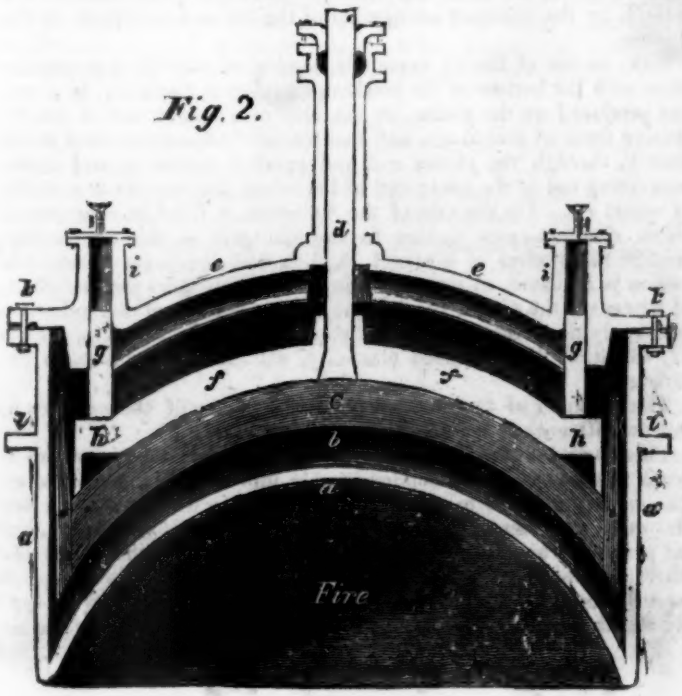
Fig. 1.

This machine resembles the steam engine in the construction and application of many of its parts, such as the cylinder and piston, the reciprocating beam and parallel motion, and the fly wheel and crank, as above represented by Fig. 1. Motion is communicated to the piston in the cylinder, *o*, by alternately heating a portion of air connected with one side of the piston, and at the same time cooling that in connexion with the other. And this is effected by means of the air vessels *a*, *a;* one of which communicates with the upper part, and the other with the lower part of the cylinder, through the nozles *m m;* the pipe *n*, forming the communication between one of the nozles *m*, and the top of the cylinder.

Fig. 2 represents a section of one of the air vessels, whose sides

are cylindrical, and top and bottom spherical. This air vessel, which is made of cast-iron, and supported in the brick work, by the projecting ledge *l l*, is furnished with a plunger, *c C c*. The top and bottom of the plunger is made of strong sheet-iron, perforated with very numerous small holes, to admit the air. The interior of the plunger is filled with very thin plates of sheet iron, so bent, as to prevent their flat surfaces from coming in contact, that the air may have a free passage between them. These are also perforated with small holes, which holes are not placed opposite to each other, but so arranged, as to cause the air to pass through the plunger in a zig-zag direction. The patentees state, that the interior of the plunger may be filled up with pieces of brick, gravel, or other granulated substance, instead of the thin sheet iron. The plunger is formed circular, to fit the top and bottom of the air vessel, when drawn up and down. The rim *c c*, of the plunger, which moves in a cylindrical receptacle at the circumference of the air vessel, as represented, is not perforated as the other part. It is kept steady by the spring *u u*, consisting of thin sheet iron, attached at its upper edge to the rim *c c*; a number of slits are made from the lower edge of the belt, to admit of its being bent outwards, to rest against the air vessel and act as a spring. The plunger is also kept steady in its ascent and

Fig. 2.



descent, by the plunger rod *d*, passing through the stuffing box at the top of its case, and the guide rods *g g*, which work in the guide cases *i i*, figs. 1 and 2. The guides are fixed to a ring *h h*, which is attached to the plunger, and the plunger rod by the arms *f f*, four in number; they are supplied with oil, by an oil cup and stop-cock at the top of their cases. The top *e e* of the air vessel, is flanched down in the manner represented at *k*, with a thin ring of sheet lead between the flanches, to keep the joining air-tight.

The lower part of the air vessel is heated by a fire place under it, and its upper part kept cool by a current of cold air, by water, or by other means.

The plunger rods of the air vessels *a a*, fig. 1, are attached by slings to the ends of the beam *v*, so that the motion which elevates one plunger in one of the vessels, depresses that in the other.

When the plunger is raised, the cold air in the upper part of the air vessel, will be heated in passing through the interstices of the plunger in its ascent, which has itself been heated on reaching the lower, or hot part of the vessel, and during this time the air in the other vessel will be cooled, by passing through the interstices of the plunger in its descent, which has itself been cooled by reaching the upper, or cold part of the vessel. These changes of temperature are further augmented, by portions of the air being alternately changed from the hot to the cold, and from the cold to the hot parts of the vessels, by the alternate occupation of the hot and cold parts by the plunger.

Now, as one of the air vessels is connected with the top, and the other with the bottom of the working cylinder *o*, there will be a motion produced on the piston, by the alternate application of the expansive force of heated air, and this motion is communicated to the beam *v*, through the piston rod and parallel motion *q*, and to the connecting rod at the other end of the beam, and the crank *r* to the fly wheel *s s*. On the axis of the fly wheel is fixed an eccentric *t*, which communicates motion to the plungers in the air vessels, through the system of levers 1, 2, 3, 4, and the beam *v*: and this motion is adjusted, so that the change of the plungers shall be effected whenever the piston reaches the top, or bottom, of the cylinder; thus applying to that end of the cylinder where the piston is, the hot air, which, by its increased elasticity, will drive the piston to the other end.

The diameter of the nozle *m* is $\frac{1}{3}$ the diameter of the cylinder *o*, and one-fifteenth of the diameter of the air vessel *a*.

This engine is also furnished with an air pump, the piston rod of which is shown at *x*, for condensing air into the air reservoir *w w*. The air is permitted to pass through self-acting valves into the nozles *m m*, and thence into the cylinder *o*, or the air vessels *a a*, but not permitted to return from these vessels or the cylinder into the reservoir, which is also provided with a safety valve for the escape of superfluous air, when more is pumped in than is necessary to supply the air vessels. The diameter and length of the stroke of the air

pump are half those of the cylinder, but this appendage is not required to be kept constantly at work.

The patentees state, that any of the permanent gases may be employed, instead of atmospheric air. They do not claim as their invention, the application of these bodies to produce motion; but merely the above arrangement of machinery, for applying the elastic force of gaseous bodies to the production of motion. [*Ibid.*

Description of the Itinerant Gasometer, patented by MESSRS. COLES & NICHOLSON, *of Manchester.* Enrolled, August, 1827.

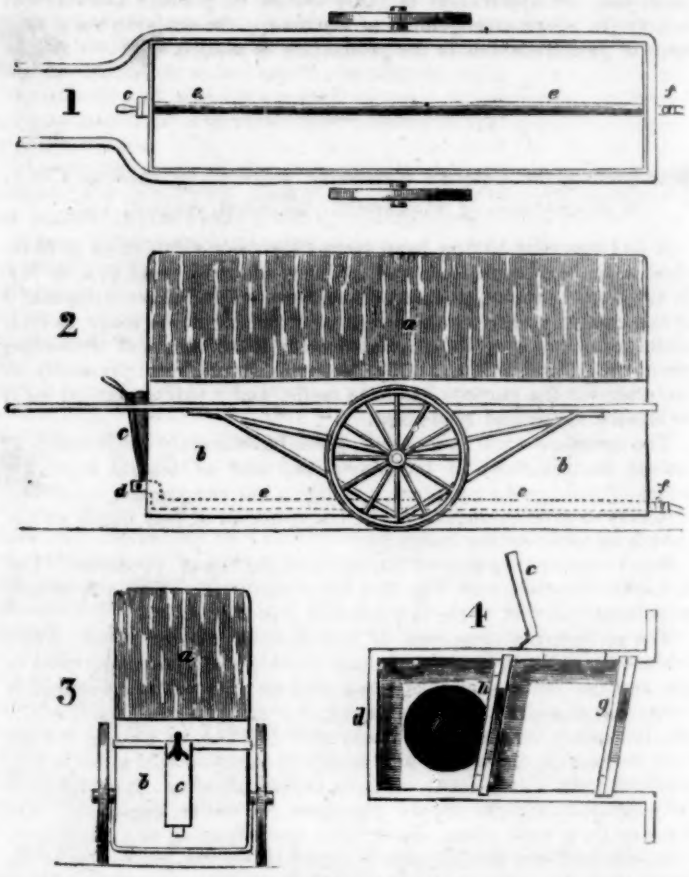
A GAS company having been some time since established in Manchester, for the preparation and delivery of *compressed gas*, in Mr. D. Gordon's portable gas lamps, it has very recently been determined by the company, that an important addition might be made to their useful establishment, by combining with it the means of delivering gas in its natural volume, under common atmospheric pressure; an invention for the purpose has been made, and a patent granted for it to Messrs. Coles and Nicholson.

The specification of this patent, gives an elaborate explanation of various modifications of the apparatus, and of several ingenious modes of making the recipient, gas-tight; but our present intention, is merely to give an outline of the construction of that which we believe is adopted by the company.

Fig. 1 represents a plan of the cart with the top of it removed. Fig. 2, a side elevation; and Fig. 3, a front elevation. Fig. 4 is merely an enlarged section of the box marked *d* in Fig. 2.

The recipient is composed of two distinct parts or halves, *a* and *b;* the upper part *a*, is made of some flexible material, impervious to gas, and the lower part *b*, of some stiff or comparatively inflexible substance; when the vessel is empty, the part *a* turning itself inside out, falls down inside of *b*. The vessel is filled, by forcing the gas from the works, through a pipe which is screwed into a nozle at *f*, provided with a stop-cock, which is turned off after the recipient is fully inflated, and the supply pipe from the works, removed. The machine then sails along the streets, and stopping at a customer's door, one end of a flexible pipe is screwed into the gas-holder of the house, and the other end into a nozle in the box *d*, which communicates with the interior of the recipient by means of intermediate valves, shown at Fig. 4. The gas exhauster *c*, is then put in motion by the handle at top, which at every exhausting stroke, is filled with gas from the gas-cart, through the valve *g*, Fig. 4, and by the forcing stroke is discharged through the valve *h*, and along the flexible pipe, into the gas-holder of the house, until the required quantity is transferred. The gas-cart thus proceeds from house to house, until the whole *load* is discharged. Along the bottom of the cart is a pipe *e*, connected at one end with the stop-cock *f*, and at the other with the

box *d* of the exhauster, and perforated with numerous small holes, for the purpose of allowing the passage of the gas along the bottom of the cart, when the flexible top lies over it.



On Chloride of Lime, or Bleaching Powder. By ANDREW URE, M. D., F. R. S., &c.*

CHLORIDE of lime, the bleaching salt or bleaching powder of Mr. Tennant, is called, in commerce, oxymuriate of lime.

* In the list of premiums offered by the Franklin Institute, for the present year, will be found one for chloride of lime. We have, therefore, thought this a fit opportunity for publishing the article on this subject from Dr. Ure's Dictionary of Chemistry. EDITOR.

In the researches which I have made, at many different times, on the nature of the chloride of lime, I have generally sought to combine the information flowing from both synthesis and analysis; that is, I first converted a known portion of hydrate of lime into bleaching powder, and then subjected this to analysis. Among the results of experiments in my note-book of 1815, I find the following: 500 grains of unslacked quicklime, in fine powder, from Carrara marble, were exposed in a glass globe to a copious steam of chlorine, previously passed through a little cold water, for four days. The increase of weight was noted from time to time, and was found, at the end of that period, to be only 30 grains, which subsequent examination showed to be due to a little hydrated chloride; the few grains of water requisite having been derived from the great body of undried gas which had been transmitted. In May, 1817, an experiment is recorded, in which 400 grains of a hydrate of Carrara lime, equivalent to 291.28 grains of dry lime, were exposed for two days to a stream of chlorine, washed in water of 50°, and refusing to absorb more gas, were found heavier by 270.5 grains. Supposing this augmentation to be chlorine, we shall have the composition of the powder, by the synthetic mode, as follows:

Chlorine,			40.34
Dry lime,	43.46	} Hydrate,	59.66
Water,	16.20		
			100.00

This powder was analyzed, by acting on a given weight of it with dilute muriatic acid, in a pear-shaped glass vessel. Care was taken to remove the whole disengaged chlorine, without letting any liquid escape. The lime was converted into carbonate, by a solution of carbonate of ammonia. The following are the results of two independent analytical experiments:

	1st Experiment.	2nd Experiment.
Chlorine evolved,	40.60	39.40
Lime,	42.27	42.22
Water,	17.13	18.38
	100.00	100.00

I have reason to believe the second experiment the more correct of the two, and if the synthetic result be compared with it, we are led to infer that the very great body of undried chlorine passed over the lime, had deposited two per cent. of water. By other experiments I satisfied myself, that dilute muriatic acid expelled nothing but pure chlorine, for the whole gas disengaged is absorbed on agitation with mercury. It does not appear possible to reconcile the above chlorides to a definite atomic constitution. The following experiments were made with much care last spring:

200 grains of the atomic protohydrate of pure lime were put into a glass globe, which was kept cool by immersion in a body of water

at 50°. A stream of chlorine, after being washed in water of the same temperature in another glass globe, connected to the former by a long narrow glass tube, was passed over the calcareous hydrate. The globe with the lime was detached from the rest of the apparatus from time to time, that the process might be suspended as soon as the augmentation of weight ceased. This happened when the 200 grains of hydrate, containing 151.9 of lime, had absorbed 130 grains of chlorine. By one analytical experiment it was found, that dilute muriatic acid expelled from 50 grains of the chloride 20 grains of chlorine, or 40 per cent.; and by another, from 40 grains 16.25 of gas, which is 40.6 per cent. From the residuum of the first, 39.7 grains of carbonate of lime were obtained by carbonate of ammonia; from that of the second, 36.6 of ignited muriate of lime. The whole results are therefore as follows:

	Synthesis.	1st Analys.	2nd Analys.	Mean.
Chlorine,	39.39	40.00	40.62	40.31
Lime,	46.00	44.74	46.07	45.40
Water,	14.60	15.26	13.31	14.28
	100.00	100.00	100.00	100.00

Though the heat generated by the action of the dilute acid has carried off, in the analytical experiments, a small portion of moisture with the chlorine, yet their accordance with the synthetic experiment is sufficiently good to confirm the general results. The above powder appears to have been a pure chloride, without any mixture of muriate. But it exhibits no atomic constitution in its proportions.

To 200 grains of that hydrate of lime, 30 grains of water being added, the powder was subjected to a stream of chlorine in the above way, till saturation took place. Its increase of weight was 150 grains. It ought to be remarked, that in this and the preceding experiment there was no appreciable pneumatic pressure employed, to aid the condensation of the chlorine. In the last case, we see that the addition of 30 grains of water has enabled the lime to absorb 20 grains more of chlorine, being altogether a quantity of gas nearly equal to that of the dry lime. Thus an atom of lime seems associated with 7-9ths of an atom of chlorine. Analysis by muriatic acid confirmed this composition. It gave,

Chlorine,	39.5 = 51.8 cubic inches.
Lime,	39.9
Water,	20.6
	100.0

I next exposed some of this powder to heat in a small glass retort, connected with the hydro-pneumatic trough. Gas was very copiously disengaged, at a temperature far below ignition, the first portions coming off at the heat of boiling water; 100 measures of the collected gas being agitated with water at 50° F., 63 measures were absorbed, and the remaining 37 measures were oxygen, nearly pure. The smell

of the first evolved gas was that of chlorine, after which the odour of euchlorine was perceived, and latterly the smell nearly ceased, as the product became oxygen. Having thus ascertained the general products, I now subjected to the same treatment 100 grains of the same powder (that last described,) in a suitable apparatus; 30 cubic inches of gas were obtained from it, in a series of glass cylinders, standing over water at 50°. The first received portion was chlorine, nearly pure, but towards the end, when the heat approached, or was at ignition, oxygen became the chief product. The residuary solid matter yielded to water a solution of muriate of lime, containing 30 grains of the dry salt, equivalent to about 15 of lime. But the chloride, both by synthesis and analysis, seemed to contain in 100 grains 51.8 cubic inches of chlorine, (corresponding to 25.9 of oxygen,) with 39.9 of lime. Thus the volume of the evolved gas proves, independent of other considerations, that a considerable portion of chlorine came off, without dislodging the oxygen from the calcium; and as in subsequent experiments this volume was found to vary with the strength of the powder, and the mode of heating it, this method of analysis becomes altogether nugatory and delusive. The truth of this conclusion will still further appear on reflecting, that an uncertain portion of chlorine is condensed in the water of the trough, and that most probably a little euchlorine is formed at the period when the gaseous product passes from chlorine to oxygen. Thus, of the 39.9 grains of lime present in the chloride, 24.9 seem to have merely parted with their chlorine, while the other 15 lost their oxygen, equivalent to $12\frac{2}{3}$ cubic inches, or 4.3 grains, and the remaining 10.7 of calcium combined with 19.3 of chlorine, to constitute the 30 grains of ignited muriate of lime. But 19.3 grains of chlorine form 25.3 cubic inches; hence $51.8 - 25.3 = 26.5$ is the volume of chlorine disengaged by the heat, to which, if we add $12\frac{2}{3}$ cubic inches of oxygen, the sum 39.16 is the bulk of gas that should have been received. The deficiency of 9.16 cubic inches is to be ascribed to absorption of chlorine (and perhaps of euchlorine,) by the water of the pneumatic trough. In the above case, about one-half of the total chlorine came off in gas, and the other half combined with the basis of the lime, to the exclusion of its oxygen. I have observed, that the proportion of chlorine to that of oxygen given off by heat, increases, as one may naturally imagine, with the strength of the bleaching powder. When it is very weakly impregnated with chlorine, as is the case with some commercial samples, then the evolved gas consists in a great measure of oxygen.

Of the Manufacture of Bleaching Powder.

A great variety of apparatus has been, at different times, contrived for favouring the combination of chlorine with slacked lime, for the purposes of commerce. One of the most ingenious forms was that of a cylinder, or barrel, furnished with narrow wooden shelves within, and suspended on a hollow axis, by which the chlorine was admitted, and round which the barrel was made to revolve. By this

mode of agitation, the lime-dust being exposed on the most extensive surface, was speedily impregnated with the gas to the requisite degree. Such a mechanism I saw at MM. Oberkampf and Widmer's celebrated *fabrique de toiles peintes*, at Joüy, in 1816. But this is a costly refinement, inadmissible on the largest scale of British manufacture. The simplest, and in my opinion the best, construction for subjecting lime-powder to chlorine, is a large chamber, eight or nine feet high, built of siliceous sandstone, having the joints of the masonry secured with a cement composed of pitch, rosin, and dry gypsum, in equal parts. A door is fitted into it at one end, which can be made air-tight by strips of cloth and clay-lute. A window in each side enables the operator to judge how the impregnation goes on by the colour of the air, and also gives light for making the arrangements within, at the commencement of the process. As water-lutes are incomparably superior to all others, where the pneumatic pressure is small, I would recommend a large valve, or door, on this principle, to be made in the roof, and two tunnels of considerable width at the bottom of each side wall. The three covers could be simultaneously lifted off by cords passing over a pulley, without the necessity of the workman approaching the deleterious gas, when the apartment is to be opened. A great number of wooden shelves, or rather trays, eight or ten feet long, two feet broad, and one inch deep, are provided to receive the riddled slacked lime, containing generally about 2 atoms of lime to 3 of water. These shelves are piled one over another in the chamber, to the height of five or six feet, cross-bars below each keeping them about an inch asunder, that the gas may have free room to circulate over the surface of the calcareous hydrate.

The alembics for generating the chlorine, which are usually nearly spherical, are in some cases made entirely of lead, in others, of two hemispheres joined together in the middle, the upper hemisphere being lead, the under one, cast-iron. The first kind of alembic is enclosed, for two-thirds from its bottom, in a leaden or iron case; the interval of two inches between the two being destined to receive steam from an adjoining boiler. Those which consist below of cast-iron, have their bottom directly exposed to a very gentle fire; round the outer edge of the iron hemisphere, a groove is cast, into which the under edge of the leaden hemisphere sits, the joint being rendered air-tight by Roman or patent cement.* In this leaden dome there are four apertures, each secured by a water-lute. The first opening is about ten or twelve inches square, and is shut with a leaden valve, with incurvated edges, that sit in the water-channel at the margin of the hole. It is destined for the admission of a workman to rectify any derangement in the apparatus of rotation, or to detach hard concretions of salt from the bottom. The second aperture is in the centre of the top. Here a tube of lead is fixed, which descends nearly

* A mixture of lime, clay, and oxide of iron, separately calcined, and reduced to a fine powder. It must be kept in close vessels, and mixed with the requisite water when used.

to the bottom, and down through which the vertical axis passes, to whose lower end the cross-bars of iron, or of wood, sheathed with lead, are attached, by whose revolution the materials receive the proper agitation for mixing the dense manganese with the sulphuric acid and salt. The motion is communicated either by the hand of a workman applied from time to time to a winch at top, or it is given by connecting the axis with wheel work, impelled by a stream of water, or a steam engine. The third opening admits the syphon-formed funnel, through which the sulphuric acid is introduced; and the fourth is the orifice of the eduction pipe.

Manufacturers differ much from each other in the proportion of their materials for generating chlorine. In general, 10 cwt. of salt are mixed with from 10 to 14 cwt. of manganese, to which mixture, after its introduction into the alembic, from 12 to 14 of sulphuric acid are added, in successive portions. That quantity of oil of vitriol must, however, be previously diluted with water, till its specific gravity becomes about 1.65. But, indeed, this dilution is seldom actually made, for the manufacturer of bleaching powder almost always prepares his own sulphuric acid for the purpose, and therefore carries its concentration no higher in the leaden boilers than the density of 1.65, which, from my table of sulphuric acid, indicates 1-4th of its weight of water; and therefore 1-3d more of such acid must be used.

The fourth aperture, I have said, admits the eduction pipe. This pipe is afterwards conveyed into a leaden chest, or cylinder, into which all the other eduction pipes also terminate. They are connected with it simply by water-lutes, having a hydrostatic pressure of 2 or 3 inches. In this general *diversorium* the chlorine is washed from adhering muriatic acid, by passing through a little water, in which each tube is immersed; and from this, the gas is led off by a pretty large leaden tube, into the *combination room*. It usually enters in the top of the ceiling, whence it diffuses its heavy gas equally around.

Four days are required, at the ordinary rate of working, for making good, marketable bleaching powder. A more rapid formation would merely endanger an elevation of temperature, productive of muriate of lime, at the expense of the bleaching quality. But skilful manufacturers use here an alternating process. They pile up, first of all, the wooden trays only in alternate shelves in each column. At the end of two days the distillation is intermitted, and the chamber is laid open. After two hours the workman enters, to introduce the alternate trays, covered with fresh hydrate of lime, and at the same time rakes up, thoroughly, the half-formed chloride in the others. The door is then secured, and the chamber, after being filled for two days more with chlorine, is again opened, to allow the first set of trays to be removed, and to be replaced by others containing fresh hydrate, as before. Thus the process is conducted in regular alternation; thus, to my knowledge, very superior bleaching powder is manufactured, and thus the chlorine may be suffered to enter in a pretty uniform stream. But for this judicious plan, as the hydrate

advances in impregnation, its faculty of absorption becoming diminished, it would be requisite to diminish proportionately the evolution of chlorine, or to allow the excess to escape, to the great loss of the proprietor, and, what is of more consequence, to the great detriment of the health of the workmen.

The manufacturer generally reckons on obtaining from one ton of rock-salt, employed as above, a ton and a half of good bleaching powder. But the following analysis of the operation will show, that he ought to obtain two tons.

[TO BE CONTINUED.]

A descriptive Account of the several Processes which are usually pursued, in the Manufacture of the Article known in Commerce by the name of Tin-Plate. By SAMUEL PARKES, F. L. S., *&c. Abridged for the Boston Journal of Science, from a paper read before the Philosophical Society of Manchester.*

ENGLISH bar-iron of the finest quality, called tin-iron, and which is generally prepared with *charcoal* instead of mineral coke, and made with the greatest care, for this particular purpose, is first cut to the necessary length, and then rolled at the mill, by a process which is peculiar to this manufacture, into plates of the requisite thinness, and of such form as is suitable for the business. These plates are then cut by hand-shears, to the sizes suitable to the different markets. And as the shearer shears the plates, he piles them in heaps, occasionally putting one plate the cross way, to keep each box separate. Two hundred and twenty-five plates are called a box, but they are not put into boxes of wood in this stage of the operation. The iron plates now go into the hands of the *scaler*, who takes them from the shear-house, and bends each of them singly across the middle, into this form ⋁, preparatory to their being cleaned for tinning, and for the conveniency of putting them into the scaling furnace, as will be more fully explained hereafter.

This furnace, or oven, is heated by *flame* thrown into it from a fire-place of a peculiar construction, and it is this flame that scales the plates, which are put into the oven in rows, and arranged three in each row, until the oven is full. It will be obvious, that if they lay flat on the floor of the oven, the flame could play only on one side of each plate, whereas, by being bent in the form already described, the flame can operate equally on both sides. It may here be remarked, that the form of all tin-plates, one sort excepted, is that of a parallelogram, and that if a piece of stiff paper, or pasteboard, 13¾ inches long, and 10 inches wide, be bent in the centre at an angle of about sixty degrees, and then put to stand on the two ends, we shall have the form of a plate No. 1. properly bent for the scaling oven.

The operation of *cleansing*, as it is called, and which is preparatory to the process of scaling, is commenced by steeping the plates, for the space of four or five minutes, in a mixture of muriatic acid

and water, in the proportion of four pounds of acid to three gallons of water. This quantity of the diluted acid will generally be sufficient for eighteen hundred plates, or eight boxes of 225 plates each.

When the plates have been steeped for the time prescribed, they are taken out of the liquor, and placed upon the floor, three in a row, and then by means of an iron rod put under them, they are conveyed to a furnace heated red-hot, where they remain until the heat takes off the scale, the removal of which was the object in submitting them to that high temperature.

When this is effected, the plates are taken to a floor, where they are suffered to cool—they are then straightened, and beaten smooth upon a cast-iron block. The workman knows by the appearance of the plates during this operation, whether they have been well scaled—for if they have, that is, if the rust or oxide which was attached to the iron, has been properly removed, they will appear mottled with blue and white, something like marbled paper. The operation we have been describing is called *scaling*.

As it is impossible the plates can go through this process without being in some measure warped, or otherwise disfigured, they are now rolled a *second* time, between a pair of cast-iron rollers, properly hardened and finely polished. This operation makes both sides of the plates perfectly smooth, and imparts a sort of polish to their surfaces. These rollers, are each about seventeen inches long, and 12 or 13 inches in diameter—but I am inclined to think, that if the diameter was greater,* they would set the plates flatter, and do the work better in every respect.

The technical name of this apparatus is *rolls*, not *rollers*. All the rolls which are employed in rolling plates, either hot or cold, in this manufactory, are *hard* rolls—and there is as much difference between a pair of *hard* cast-iron rolls, and a pair of *soft rolls*, although they may both be run out of the same pot of metal, as there is between iron and steel. The workmen inform me that the difference is entirely occasioned by the manner of casting them—the soft rolls being cast in sand, whereas, the hard rolls are formed by pouring the metal into a thick cast-iron box—and that the metal, by coming in contact with the cold box, is sufficiently chilled to render the whole face of the roll entirely hard. The difference in the temper of these two kinds of rolls is so great, that when they are put into the lathe to be turned perfectly true, the turnings from the one will be $\frac{1}{8}$th of an inch in thickness, whilst the turnings which come from the other are not larger than very fine needles. The temper of cast-iron, thus varying according to the nature of the mould into which it is poured, is a circumstance that appears to me to be deserving of attention, in the manufacture of a variety of other utensils employed in the arts.

These rollers are used without heat, but they are screwed down very close one upon the other, only leaving bare room for the plates

* Since the above was written, I have submitted the manuscript to a gentleman who is very largely engaged in the manufacture of tin-plates, and he tells me, that the cold rolls which are employed in his work, are 30 inches in diameter.

to pass, that the utmost attainable degree of pressure may be given to them. This last operation is called COLD ROLLING.

When the plates have undergone this process, they are put, one by one, into troughs filled with a liquid preparation called *the lies.*

This is merely water, in which bran has been steeped for nine or ten days, until it has acquired a sufficient acidity for the purpose. The design of putting the plates into the troughs, *singly*, is, that there may be more certainty of the liquor getting between them, and both the sides of every plate being soaked alike in the lies. In this liquor they remain for ten or twelve hours, standing on the edges, but they are turned, or inverted, once during the time. This operation is called *working* in the lies.

The next operation is that of steeping in a mixture of sulphuric acid and water, in proportions which vary according to the judgment of the workmen.

The trough in which this operation is conducted, is made with thick lead, and the interior is divided by partitions of lead. Each of these divisions is by the workmen called a *hole*, and each of them will contain about one box of plates. In the diluted sulphuric acid, which is in the different compartments of this vessel, the plates are agitated for about an hour, or until they have become perfectly bright, and entirely free from the black spots which are always upon them when they are first immersed in it.

Some nicety, however, is required in this operation, for if they remain too long in the acid, they will become stained, or blistered by it, as the workmen term it; but practice enables a careful operator to judge of the time when they ought to be removed. This, however, is one of the most difficult parts of the business, as few men like to work in it; though I understand, that a good pickler is highly valued by his employers, and obtains great wages. It is necessary to notify that this, and the former process with the acidulated water, are both hastened by giving to those menstrua an increase of temperature—and this is effected by means of heated flues which run under each trough. Little additional heat is necessary in summer, however, as 90° or 100° of Fahrenheit is a temperature sufficiently high for either of these operations.

When the plates come out of the pickle, they are put into pure water, and scoured in it with hemp and sand, to remove any remaining oxide, or rust of iron, that may be still attached to them, for wherever there is a particle of rust, or even *dust* upon them, there the tin will not fix; and they are then put into fresh water, to be there preserved for the process of tinning. The design of putting the plates into pure water, after they come out of the sours, is to prevent their becoming again oxidated—for it has been found that after these operations, they will acquire no rust, although they should be kept twelve months immersed in water.

It will be perceived that all these processes are nothing more than preparatory measures, for the operation which is to succeed, viz. that of TINNING.

For this purpose, an iron pot is nearly filled with a mixture of

block and *grain* tin, in a melted state; and a quantity of tallow or grease, sufficient, when melted, to cover the fluid metal, to the thickness of four inches, is put to it. However, as some gentlemen may not be acquainted with the difference between *block* and *grain* tin, it may be remarked, before we proceed, that the metal known in commerce by the name of block tin, is prepared either from the mineral called *tin-stone*, or the one known in Cornwall by the name of *tin-pyrites;* whilst the article called *grain-tin* is smelted from an ore which is found in grains called *stream tin* ore, under beds of alluvial soil, in low situations, whither, in the course of ages, it has been washed from the hills by a succession of torrents of rain. The former, which is produced in the greatest abundance, is always contaminated with a portion of iron, sulphur, and other injurious substances, and is, therefore, only employed for common purposes—while the grain tin, which is nearly free from every impurity, and usually from twenty to thirty shillings per hundred weight dearer, is used in the processes of dying, and in all other cases where *pure* tin is required. I am also desirous of remarking, that, in my opinion, it would be more profitable to the proprietor of a tin-plate work, if he were to use *grain* tin alone, or grain tin mixed with that kind which is known by the name of "Refined Tin," because these kinds not only contain less dross, but they melt, as I know by my own experience, into a more fluid metal; and consequently, more would run off the plates in the operation of tinning, and less tin would be consumed. At present, these manufacturers use the block and grain tin, in equal proportions.

When the tin-pot has been charged in the way above mentioned, the metal is heated from a fire-place underneath it, and by flues which go round the pot, until it is as hot as it can be made without actually inflaming the grease which swims upon its surface. The use of the grease is to preserve the tin from the action of the atmosphere, and consequently to prevent it from oxidating. By melting a little tin or lead in an iron ladle, and, when the dross is skimmed off, putting a morsel of tallow upon the metallic fluid, the effect of the tallow in cleansing the face of the metal will be evident. The workmen also say, that it increases the affinity of the iron for the tin, or, as they express it, that it makes the iron plates take the tin better.

It is curious that *burnt grease*, or any kind of empyreumatic fat, effects this purpose better than pure, fresh tallow.

Another pot, which is fixed by the side of the tin-pot, is filled with grease only; and in this the prepared plates are immersed, one by one, before they are treated with the tin; and when the pot is filled with them, they are suffered to remain in it so long as the superintendent thinks necessary. If they remain in the grease an hour, they are found to tin better than when a shorter time is allowed them.

From this pot they are removed, with the grease still adhering to them, into the pot just before spoken of, which contains the body of melted tin; and in this, they are placed in a vertical position. Three

hundred and thirty-eight, or three hundred and forty plates are usually put into this pot at once; and, for the sake of their being thoroughly tinned, they usually remain in it one hour and a half; but occasionally, more time is required to complete this operation.

When the plates have lain a sufficient time immersed in the melted tin, they are taken out and placed upon an iron grating, that the superfluous metal may drain from them; but, notwithstanding this precaution, when they become cold there is always more metal found adhering to them than is necessary; and this is taken off by a subsequent process, called *washing*. As this process is rather complicated, it will be necessary to describe it with some minuteness.

[TO BE CONTINUED.]

Account of the Island of Ceylon, its Agriculture, and the Processes followed in several arts by the Natives.

In the year 1809, the government of England, with a view of introducing British capital, machinery, British industry, and skill, into the ISLAND OF CEYLON, authorized, on the suggestion of Sir Alexander Johnston, (then president of the king's council in Ceylon,) the Ceylon government to annul, entirely, the restrictions which had theretofore been adopted against allowing any English, or other Europeans, to possess lands in the island of Ceylon, and to give every encouragement to Europeans to take grants of land in Ceylon. Since this period, Dr. Davy has published an interesting history of the Island, with much information respecting its agriculture. From this work, principally, the following account is extracted.

Agriculture is in no part of the world more respected or more followed, than in the interior of Ceylon. In common with all other arts, it is marked with great simplicity.

Most of the operations in the cultivation of paddy, (rice,) which is carried on wherever water for irrigation can be procured, are connected with, or have some relation to, the element on which its success depends. The farmer commences with repairing the banks of the paddy-field. He then admits water in sufficient quantity, to be an inch or two deep over the whole surface. After the ground has been well macerated and softened, he ploughs it, still under water. After further maceration, it is ploughed again, or merely trampled over by the buffaloes, till reduced to the state of mud: its surface is now levelled and smoothed. The water is drawn off, and the paddy, having been previously steeped in water until it has begun to germinate, is sown with the hand, and is scattered as equally as possible over the moist surface of mud. When the seed has taken root, and before the mud has had time to dry, the openings through which the water was drawn off are closed, and the field is again inundated. When the paddy is two or three inches high, it is weeded; and where the seed has failed, the vacant spots are planted from those parts which are too thick, and require thinning. The irrigation is

continued, till the paddy is nearly full grown, and about to ripen, when openings are made in the banks, and the field is drained. As soon as ripe, the paddy is cut with reaping hooks, and immediately carried to the threshing-floor, where the grain is trampled out by buffaloes. From the moment the seed is sown, to the period of harvest, the paddy-field, like the chenas, requires constant night watching, to protect it from the depredations of its wild enemies. In the low countries, where the cultivation of paddy is in a great measure dependant on the rainy season, and on artificial reservoirs, for a farther supply of water, only one crop is procured annually; but amongst the mountains, in situations where perpetual irrigation is at command, the seasons are less concerned: the farmer can sow when he pleases, and from good ground annually obtain two, and it is said even three crops. One crop a year of the best paddy, which requires seven months, is, however, the most common: when two crops are procured, they are of an inferior grain, that comes to maturity in three or four months.

The hilly and mountainous districts, in consequence of being well supplied with water, are thus peculiarly favourable for the cultivation of this important grain; and it is a most fortunate circumstance that they are so; otherwise, the coolest, most salubrious, and most beautiful parts of the interior, would, instead of being cultivated to a certain extent, be quite neglected and deserted. In the low country, the paddy-fields are generally of a large size, and apparently quite flat; and every crop being in the same state of vegetation, or nearly so, the whole exhibits very little variety of surface. Amongst the mountains it is quite different; paddy-fields there, are a succession of terraces, or flights of steps; and in each field the crop may be in different stages of growth,—in some, just vegetating, in others full grown, ripening, or ripe; there, at the same time, you may see the labourers at all their different operations,—banking, ploughing, sowing, weeding, reaping, and treading out the grain. Dr. Davy observes that he does not know any scene more interesting, than a highland valley thus cultivated, or more beautiful, when (as it generally is,) it is surrounded by the bold, wild, and frequently savage scenery, of untamed nature. In the low lands, the labour and skill required to cultivate paddy, are less than are necessary in the high lands. In cutting terraces in the sides of the hills, the perseverance and industry of the mountaineer, are often in a striking manner displayed. Many of the beds are actually walled up, and many of them are not four feet wide, and though generally long, occasionally they are, from the nature of the ground, so short, as well as narrow, that one would not suppose they were worth the labour of keeping in repair, much less that of making. In bringing water to his fields, and insuring them a constant supply, the judgment and skill of the cultivator are most exercised. Sometimes it is conducted two or three miles along the side of a hill, and occasionally, it is even carried from one side of a mountain to another, by means of wooden pipes.

The implements of husbandry employed by the Singalese are few

in number, of a very simple description, and resemble ours in many particulars. For cutting down trees, and clearing underwood, they have a *wal-dakat*, or jungle-hook, Fig. 1, and a *proa*, or axe, Fig. 2: their *udala*, Fig. 3, Dr. Davy states, (we think erroneously,) is for digging where the plough cannot be used, and for banking.

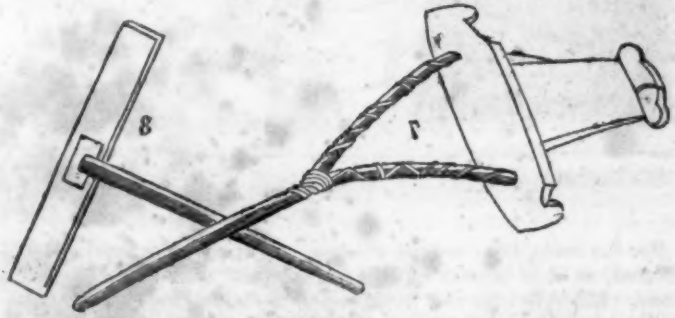
Similar instruments to these, but superior in their quality, may be procured of our own manufacturers. We do not remember to have seen any thing exactly like Fig. 1, ready made, but an excellent substitute will be found in the heavier kind of West India matchets, used for cutting down sugar canes. Fig. 2 is, decidedly, our common felling axe for trees, the only material variation being in the pole or thick part at the back, which in the Singalese is rounded or made convex, while ours is made flat in that part, and is used by the carpenters frequently in lieu of a heavy hammer. Fig. 3, is in all respects like some of our country axes; that peculiar manner of forming the eye for the handle is defective, and is only adopted as a readier and cheaper way of making the tool; the eyes in the best axes are always made the length of the pole, as in Fig. 2.

The Singalese plough, *naguela*, is of the simplest and lightest kind, as delineated at Fig. 4; and this plough is attached to a yoke, *viaga*, Fig. 5, and drawn by a pair of buffaloes, the husbandman holding the plough by one hand, while in the other he holds a goad, *kaweta*,

Fig. 6, with which, and his voice, he directs and stimulates the animals.

As a substitute for this miserable machine for tillage, it is gratifying and encouraging to learn, that the Scotch plough, drawn by elephants, has lately been introduced by some new settlers, with eminent success; its potent operation in accelerating the work, has, we understand, made it a great favourite with the natives.

For levelling the ground after ploughing, they use the *anadatpoorooa*, Fig. 7; which, like the plough, is drawn by a pair of buffaloes, the driver sitting on it, to give it momentum. For smoothing the surface of the mud, preparatory to sowing, the light hand instrument, the *atpoorooa*, or *goelalé*, Fig. 8, is employed.



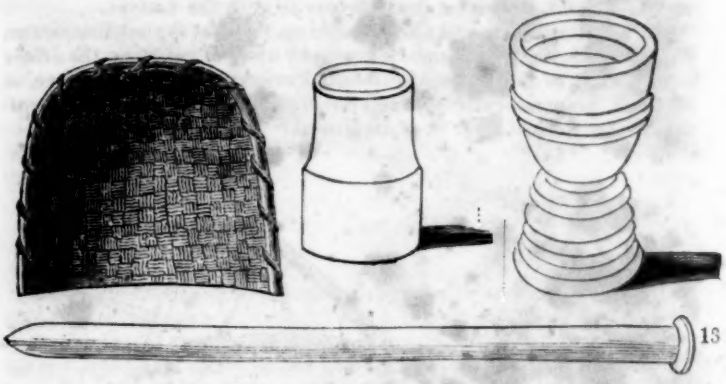
For the *anadatpoorooa*, the repositories of our agricultural implement makers will afford many improved substitutes; a light harrow must surely be better adapted for levelling after the plough. The blade of the *atpoorooa* would of course be better of sheet-iron than of wood.

The reaping-hook, called by the Singalese *guygon-kopana-dakat*, Fig. 9, has a fine serrated edge. This reaping-hook is made rather clumsier than ours, but in other respects is the same: the manufacture of this article in England is superior in quality to that of all the world, and at an inferior price.

After reaping, the grain is trampled out from the straw by buffaloes, upon a floor made of beaten clay. For separating the chaff from the grain, they use the winnow, *coola*, delineated at Fig. 10, which is composed of strong matting and a frame of tough twigs. The husking is, of course, but very imperfectly done in this way;

accordingly, the Singalese use subsequently a pestle and mortar, for completing the operation of husking, preparatory to pounding it for food. These pestles and mortars, *wang-gadea*, represented by Figs. 11, 12, and 13, are generally made of wood, though sometimes of stone.

10 11 12



13

For the *coola*, the common winnow, might advantageously be substituted, as it is almost equally simple, and would be more efficacious. Might not the new patent machine for husking rice, described in the present number, be introduced by the new settlers? A substitute for the inefficient apparatus employed by the Singalese, is highly important in the preparation of an article of universal and constant consumption.

Instead of the *wang-gadeas*, our cast-iron pestles and mortars might be used with great advantage.

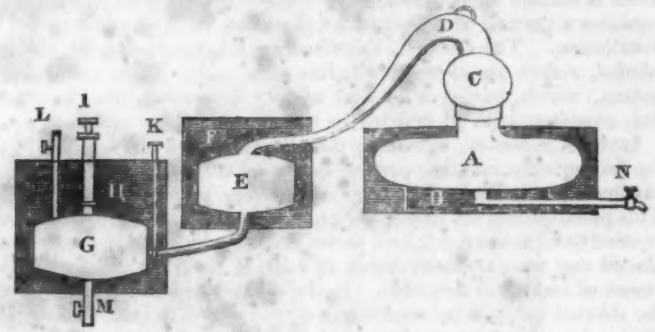
[TO BE CONTINUED.]

On Distillation in Vacuo, with a section of TRITTON's *improved apparatus for that purpose.*

THAT celebrated philosopher and mechanic, the late Mr. Watt, having ascertained that liquids boiled in vacuo at a much lower temperature than when under the pressure of the atmosphere, ingeniously applied this fact to distillation. The discovery led Mr. Tritton to construct a distilling apparatus, which, from its simplicity and economy, is well deserving the attention of the public. The vessels are arranged in the manner of Woolfe's Apparatus, and the cucur-

bite, or body of the still, is immersed in a water bath, which renders it impossible to overheat or burn the matter contained therein, and therefore prevents an empyreumatic flavour from being communicated to the spirit. The following engraving will give an idea of the plan upon which it is constructed.

Section of an Improved Still, exhibiting the Principle of Mr. Tritton's Apparatus for Distilling in Vacuo.



A is the body of the still; B is a water bath, into which the body of the still is immersed; C is the head, or capital; D is the neck of the same, which, curving downwards, is connected with a pipe that enters the condensing vessel E; F is a refrigeratory, or close vessel, containing cold water, for converting into liquid the spirituous vapours, which, having been raised in the still, are contained in the vessel E. From the bottom of the vessel E, a pipe issues for conveying the liquid, and the vapour not yet condensed, into vessel G, which, being surrounded with cold water contained in the vessel H, acts also as a refrigeratory, and reduces the whole of the remaining vapour into a liquid state. I is an air pump, for effecting a vacuum in the vessels A E G. K is a stop-cock, for cutting off the communication between the vessels E and G, when the contents of G are drawn off by the cock M, by which means a vacuum is preserved, during that operation, in the vessel E, and the still A; L is an air-cock, to admit air into vessel G, to allow the contents to run out at M; N is a discharge-cock to the still A.

It is evident, that without a vacuum being produced, the matter contained in the still can never be heated beyond 212°, that being the greatest degree of heat that the surrounding liquid, water, is capable of receiving, or transmitting. But as this apparatus affords a convenient and easy mode of removing the pressure of the atmosphere, by means of an air pump, the distillation is effected at the low temperature of 132°, and the regular application of so low a degree of heat cannot fail to produce a spirit of the purest and strongest quality.

Observations on the use of Bladders in Rectifying Spirits, with a Description of an Apparatus intended to facilitate the Process. By L. Hebert, *Engineer.*

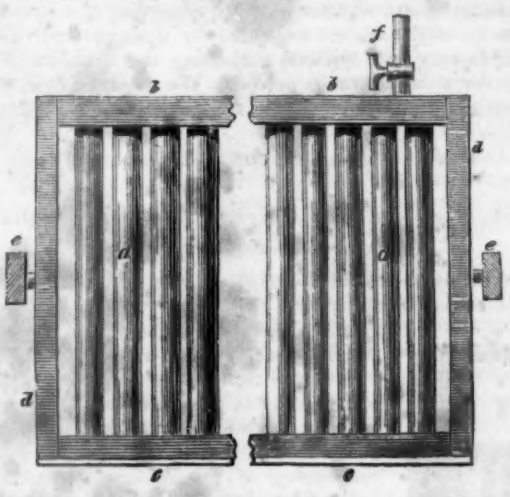
The rectification of spirits on the large scale, is usually effected by repeated and careful distillations, in stills of smaller magnitude than those first employed to separate them from the fermented wash. Thus is formed what is commonly termed *spirits of wine*, which still contains a portion of water, that cannot be wholly got rid of by re-distillation. The chemist, therefore, who has occasion for absolute *alcohol*, makes use of some alkaline salt, (such as the carbonate of potass,) which, having a greater affinity for water than the alcohol has, combines with it, and leaves the alcohol nearly pure.

Instead, however, of mixing the alkaline salt with the spirit, as in the former case, another process has been adopted in France, which has been particularly described in a former number of this Journal. This process consists in placing a quantity of the dry muriate of lime, or other deliquescent salt, in a series of large, shallow, covered vessels, placed one over another; inside of each of these, is another shallow vessel of smaller dimensions. In the upper internal vessel, is placed the diluted spirit to be concentrated: the external vessels being perfectly closed and luted, they are left for a day, for the deliquescent salt to attract, and imbibe, the water from the spirit. The salt being saturated, a cock is opened, by which the spirit, considerably increased in its strength, descends into a similar vessel beneath, which is charged as the former, with the dry muriate of lime. The concentration of the spirit being here further increased, it is allowed to flow into a third, fourth, or fifth vessel, in a similar manner, the last of which raises the spirit to perfect alcohol. The operation is thus performed wholly in the *cold*, i. e. without the application of any artificial heat whatever.

The strongest alcohol may however be obtained, by another, yet rather dilatory, process, as it has hitherto been practised. It is, to put the spirits into bladders, and suspend them in a warm room, or over a heated sand bath. Now, as bladder is pervious to water, and impervious to alcohol, the former passes out, leaving only the latter remaining, in a highly concentrated state. In a few days the diluted spirit thus exposed, loses one fourth of its volume.

We have never made this experiment ourselves, but the fact being supported by the concurrent testimony of many respectable chemists, we have no doubt of its truth. On account of the little heat necessary to effect this rectification, we cannot help thinking that it may be made one of great economy, if an apparatus can be devised for conducting the process extensively, and with little labour. For this purpose we would suggest, that instead of the ordinary animal bladder, the æsophagus of oxen, (the buffalo, or the elephant, in India,) be employed, as exposing a larger surface to the air, and as being more convenient for adapting a series of them to a suitable framing,

which we propose to be suspended upon pivots, in a heated apartment; or in warm climates, to the heat of the sun. The following diagram will explain what we will take leave to call (though not strictly correct) *a bladder rectifying apparatus.*



a a are the æsophagus bladders, distended between a framing *b b*, and *c c*, which is exhibited as broken away towards the middle, to denote that it may be made of any convenient width or length. The bars *d d* connect the upper and lower pieces, and carry the pivots or axles, which turn in the cross beams or supports *e e*, shown in section. The upper side of the frame *b b*, is intended to be formed of a square or round *tube*, in which are made circular apertures for the reception of the upper ends of the bladders, *a a*, which are to be kept open and distended by wooden rings, and properly secured by cement. The lower ends of the bladders pass through similar apertures in the bottom rail, where they are cemented, and kept closed up, and secured from injury by a board screwed over them into the rail *c c*.

We will now suppose that fifty (or any other number) of such bladders, are fixed to a frame, and charged with diluted spirit, by means of a moveable hose and nozle, leading into the tube of the open cock *f*; that done, the cock *f* is to be closed. In the same manner, let all the other frames in the apartment or manufactory be charged, of which there may be any number. If 100 frames, there would be 2 or 3000 gallons suspended, which may then be submitted to a moderate heat, no matter whether that of the sun or a stove. A building on the plan of a green-house or hot-house, would answer for both purposes.

When it is found that the spirit has parted with its aqueous fluid, in any of the frames, they are to be turned half-way round on their

pivots, by which the upper side *b b* becomes the under, and the cock being opened, the concentrated spirit may be discharged by means of a hose, into suitable recipients.

It is obvious, that by some such simple arrangement, the whole work of charging and discharging the apparatus of a very extensive manufactory, might be accomplished by a single individual, with very great facility, and without subjecting the bladders to any sensible wear for a considerable period. We shall leave others to improve upon the hints we have thus submitted.

Description of an Hydraulic Weighing Machine, invented by J. I. HAWKINS, *Civil Engineer, London.*

THE following is a brief description of a very novel and simple weighing machine made by Mr. Hawkins.

a is a cylinder made of tin, and japanned, which is partly filled with water; *b* is another cylinder of rather less diameter, resting upon and floating in the water contained in *a*:—*c* is a graduated scale with a glass tube running up the middle, fixed to the exterior cylinder, *a*; the bottom of this glass tube opens into the lower part of the cylinder, therefore the water always stands at the same level in both; *e* is a dish or scale for holding the goods to be weighed, the pressure of which causes the internal cylinder to sink lower and raise the water higher in the same proportion, and the exact weight is indicated by the graduated line on the scale, which is upon a level with the surface of the column of water contained in the glass tube; precisely in the same manner as the temperature of the atmosphere is shown by the mercury in the tube of a thermometer. It appears upon the whole that this singular and elegant contrivance is well calculated to weigh accurately, which may at any time easily be proved by placing a given weight into the scale.

Description of an Apparatus for Speedily Drying Damp or Mildewed Corn, invented by L. HEBERT, *Engineer, London.*

IT is, I believe, a well ascertained fact, that grain may be kept uninjured for an indefinite period of time, if air and moisture be carefully excluded. If any thing were wanting to prove this, the extraordinary experiment made with the Indian corn found in the graves of the ancient Peruvians, (buried more than 300 years ago) which,

when sown, vegetated, and came to maturity, is sufficient proof of the fact to set all doubts at rest. To preserve grain, however, for only two, three, or four years, with its nutritious properties unimpaired, is all that a nation can require; as the produce of the seasons of dearth and of scarcity might then be equalized, and *bread be maintained at a low and regular price.* This the tillers of the soil and the working part of the public generally, have an undoubted right to expect from the owners of the land, in return for their labour in producing every thing for them.

It not unfrequently happens, during a wet harvest season, that the corn is necessarily carried from the field in a damp state; and as but few farmers have the means of properly and speedily drying it, large quantities are irrecoverably spoiled, after all the labour and expense of the production. The method of drying on the perforated tiled floor of a kiln is usually resorted to, *where it can be obtained;* but it is a very tedious, defective, and expensive mode; besides being attended with great labour, owing to the necessity of its having continually to be turned over and spread about by a workman, whose utmost care is insufficient to cause every part to receive an equal degree of heat.

To procure the adoption of any new apparatus for the purpose of drying corn, it is necessary that it should be of simple construction, of small cost, and occasion but little labour in its use; I have therefore thought that something of the following kind might be rendered generally eligible for the purpose, as it admits of either a large or small quantity of grain being dried at a very trifling expense, and the apparatus may be made of any size to suit the magnitude of the farm where it might be erected. The apparatus is likewise nearly self-acting, requiring scarcely any labour or attention.

I propose to have a cast iron pyramidical stove *a* in the lower part of a granary, warehouse, or barn, with a spiral tube of cast iron (something like a distiller's worm) fitted to the top of the stove, and reaching to above the roof of the building, for conveying off the smoke. I prefer cast iron for this purpose to wrought or sheet iron, on account of its greater durability, which will render repairs unnecessary for a long series of years; wrought iron stove pipes soon wear

out, are usually fitted very inaccurately at the joints, and are exceedingly troublesome. I would have the mould for my cast iron tubing made light, and have them all cast alike from one mould, in pieces about three feet long; excepting the top and bottom piece, which would necessarily vary from the others. The joints should be made by a circular rebate at each end, so accommodated that the upper end of one piece would fit accurately into the lower end of another, and so on throughout the whole length of the spiral chimney; and every joint, on putting them together, should be properly luted, to prevent the possibility of smoke escaping, which might be easily done. If an objection should be made to the weight of such a tubing, it might be easily supported (if necessary) in various obvious ways.

The grain I suppose to be deposited in the top floor of the building, or rather in one corner of the same; and it appears to me as a desirable plan, if the building should consist of several floors, that a square piece of equal area in each floor should be cut away; and that such portion should be left open from one to the other, and partitioned off from the rooms, in the same manner as a stair-case; by which means the heat radiating from the stove or tube, would be longer confined in that situation where it would be most required. If only the corner of the building were thus appropriated, it would be no inconvenience to place the grain on a small flooring of inclined planes, in the manner of a hopper, as shown at *c*. The grain would then readily run down between the interior and exterior tubes (which I shall presently describe) without the necessity of the intervention of any manual labour.

b b is another spiral tube to be made of wrought iron, and of larger dimensions than that of the cast iron chimney which it encloses. This exterior tube is to be punched (*from the outside to the inside*) with holes, but not so large as to allow a grain of corn passing through, and as numerous and as close to one another as possible. The configuration of this exterior tube should, of course, be precisely similar to the other, so as to be kept uniformly, throughout its serpentine course, at the same distance apart from it; which I propose to be about an inch and a half. The rough projections in the inside of the exterior tube, are of important service in giving a rolling motion to every individual grain, so that being spread over a very extended surface in a thin stratum, and every grain being put in motion, the heat would be communicated over every part, and the resulting vapour rapidly extricated, by its freely passing off through the perforations. The length of the passage between the tubes may be from 40 to 100 feet, according to the size of the apparatus (the longer of course the better;) and when it comes within four or five feet of the stove, I propose that the course of the exterior tube be turned from the stove pipe (which might be so much heated near the stove, as to injure the vegetative property of the grain, should it be required for sowing) and that it may pass from thence through the partition beforementioned, into some receptacle or receptacles, capable of being closed air-tight. As these receptacles should also be proof against the attacks of rats, mice, and other vermin, it is probable that the employment of metallic casings, made either of thin sheet iron, or

lead, would be most desirable. If the vermin could be altogether kept out of the granary, by some of the usual precautions, then the preserving of the grain from the air only might be an object easily and cheaply obtained. What strikes me as one of the most desirable substances to be employed for this purpose, is the new patent material in imitation of leather, recently invented by Mr. Thomas Hancock, which consists of a fibrous felted cloth, saturated with liquid elastic gum or caoutchouc. This fabric must be entirely impervious to air and moisture, and extremely pliable; I therefore think if it were made into bags for receiving the dried corn, the latter might be preserved in a perfect state for a long series of years.

I intend, however, to be understood as only submitting what I consider to be a mode of drying corn thoroughly, rapidly, and almost without trouble, preferable to those now in use, and leaving such subsequent mode of preservation to be adopted, as circumstances or situation might render eligible.

Instead of punched sheet-iron for the exterior tube, wire-work might be substituted, and the distance between the exterior and interior tubes (in either case) be preserved by means of stout cross-wires. These cross wires would offer a desirable impediment to the too rapid descent of the corn, which may, however, be regulated by merely enlarging or contracting the aperture by which the corn makes its exit.

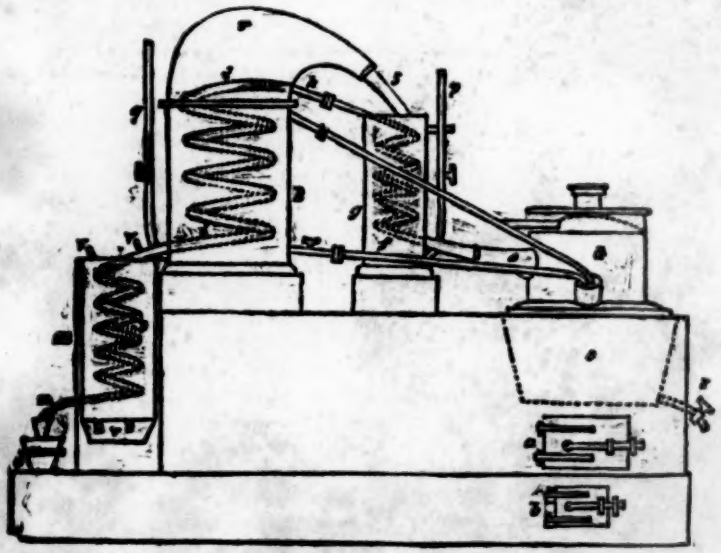
Description of SALIMAN'S *Still, as improved by* CURADAU.

WE have given several improved English and French stills, in our previous numbers, and have promised to resume this subject. In England, an oppressive and vexatious excise law, interferes with the progress of improvement in the business of distillation; and the consequence has been, that the French have excelled them in this art; that is, in the economy of the operations pursued. We now present to our readers, two of the improved French stills. The following is by Saliman and Curadau.

a is the door of the furnace, *b* the ash hole, *c* the boiler, with its large cylindrical head *d; e* the exit tube for the vapours, connected by a union joint to the worm *f*, in the tub *g*. This tub is kept filled with water, at a temperature of about 180° Faht., and the spirituous vapour that passes upward through the worm *f*, along the tube *h*, then descends through the worm *i i*, surrounded with wine in the vessel *k*, where it becomes condensed; the liquid spirit, then runs through another worm *l*, surrounded with cold water, which completely cools it, before it is discharged by the pipe *n* into the recipient *o*.

To prevent the water from becoming too hot in the tub *g*, by the passage of the heated vapour through the worm *f*, and to preserve it at an even temperature, cold water, from an elevated cistern, is introduced at the bottom, by a pipe *p*, the quantity being regulated by

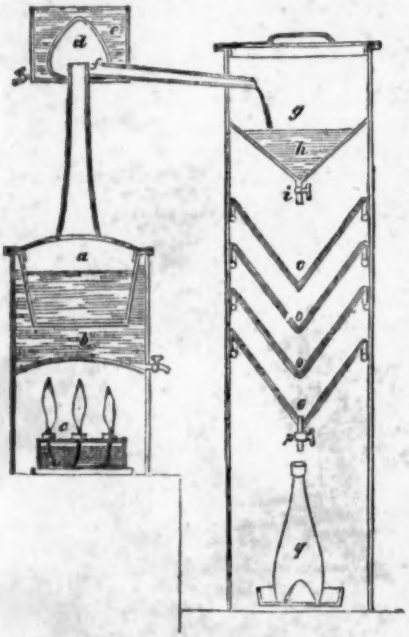
a stop-cock; and the wine which surrounds the worm *i i*, in the tub *k*, is supplied from a vessel above, by means of the pipe *q*. This wine, in the course of distillation, grows hot, it is therefore used to charge the still, as often as the former charge is worked off, and the spirits drawn off by the cock *t;* and as it is economical to take off the hottest portion, the cock in *q* is opened, when the cold wine from the cistern above enters at the bottom of *k*, and forces the upper, or heated portion, along the pipe *u*, into the boiler of the still. The spirituous vapours formed in the tub *k*, are conducted by the head *r*, and the curved neck *s*, into the worm *f*, where it takes the course of the vapours which proceed from the still. The tub *m* is kept as cold as possible, by an ingenious contrivance of Mr. Curadau's. A number of spiral pipes surround the tub on the inside, the ends of only two of which are shown in the figure, to avoid confusion. Now as the upper part of the tub is always the warmest, a current of air is produced in these pipes, which serves to cool the water in which they are placed.



The worm *f*, being surrounded with a medium at so high a temperature as 180°, only allows of the alcoholic portion of the vapour to ascend through it, the aqueous part running back into the still; so that spirits may, by this apparatus, be obtained of great strength by a single operation.

Description of the Liqueur Still used in Paris, for the purpose of Distilling Liqueurs for the Table.

a Is the boiler (containing the diluted spirits and flavouring spices,) immersed in a water bath *b*, and heated by a spirit lamp *c*, having several wicks. The still has a tall neck, surmounted by a head *d*, which is surrounded by cold water, forming the refrigeratory.



The vapour, as it is condensed, runs down the sides of the head in a liquid form, and is received in a circular channel, formed around the upper extremity of the neck: from thence it flows along a pipe through the cold water cistern, into a recipient *g*, fixed above a series of funnel shaped filterers. Previous to commencing the process of distillation, the recipient *g* is provided with a sufficient quantity of sirop (solution of white sugar,) to form the intended liqueur, over which the condensed spirit discharges itself. When all the spirit is come over, the distillation is stopped by extinguishing the lamp; the cock *i* is now opened, when the aromatic spirit and the sirop descend into the first of the filterers *o o o o*. These filterers are each composed of four distinct substances or layers; the lowest is of perforated metal, the next above, fine flannel, over which is put two thicknesses of filtering paper. The spirit and the sirop become intimately blended in passing through these successive filterers, and are received into bottles beneath in a perfectly bright and clear state.

ESSAYS ON LITHOGRAPHY.—No. VII.

Imitation of Aqua-tinta.

A NUMBER of methods have been devised to produce lithographic imitations of engravings in *aqua-tinta*, which bear a strong resemblance to those drawings produced by washing with India ink. Li-

thography, however, does not seem to admit of very perfect imitations of this kind, as many difficulties present themselves in the way of their accomplishment. The dark spots upon the stone, which produce the different shades upon the picture, must be extremely close to each other, and from the pressure necessary in taking the impressions, they are liable to spread sufficiently to become confounded together, and consequently to destroy the distinctness, and spoil the whole effect, of the drawing. We, nevertheless, think it best, for the satisfaction of our readers, to say a few words upon this subject. The Germans have tried various processes, but they have been generally given up; nor have the attempts of the French proved more successful.

We shall first describe a method which strongly resembles that followed upon copper, but in this case, pulverized gum-arabic, is employed instead of a resinous substance; the gum is rapidly sifted over the face of the polished stone, the grains being more or less fine, according to the size of the spots which it is wished to produce. This gum is affixed by a slight moistening of the stone; care being taken that it is only sufficiently humid to retain the particles of gum, without dissolving them. When the stone has become dry, that portion which does not adhere, is carefully removed; linseed oil is now to be applied to the stone, which will be imbibed by it wherever there is an interstice, or spot, not covered by the gum; the excess of oil which remains upon the surface, must be removed by blotting paper, or a soft rag. The stone may now be moistened to dissolve the gum, which must be washed off; it may then be prepared, and inked, and impressions taken from it.

A second method consists in dabbing with lithographic ink, upon a stone which has been grained; being governed in so doing by the lightness, or depth, of the shades which are wanted. To accomplish this, patterns are cut in paper, to defend those parts which are to remain white, or to preserve in others, the degree of shade which has been given to them. The same end is sometimes obtained by coatings of coloured gum-water, put upon those parts which are not to receive the ink, or which have already received the necessary quantity. Before performing this operation, the design must be traced upon the stone, or the harmony and effect of the piece cannot be preserved. Those portions which have been sufficiently charged with the ink, being covered either with the paper patterns, or with gum-water, a larger quantity may be laid upon the others; observing always, that both the ink and the gum-water, must be allowed to dry between each operation. The ink used, is mixed with water, or with spirits of turpentine, to the consistence of common printing ink; and by applying this by means of a small cushion, or dabber, the tone of shading may be graduated from any degree of lightness, to the greatest depth. After having removed the gum, washed the stone thoroughly, and allowed it to dry, the other parts of the design are finished up, either with the crayon, or the brush; the scraper is used to lighten those portions which may be too deeply shaded, and to take away any spots which it is necessary to remove. This process

requires considerable address, as it will not succeed without a minute attention to points which may appear trifling. A brush slightly charged with ink, is sometimes used instead of the dabber: the particles of ink are sprinkled on by passing the blade of a knife, or some similar article, over the points of the hairs.

Another method, which, although it has not been followed, might probably answer well, would be to draw the shadows with crayons upon a grained stone, and afterwards to blend them, by rubbing them with a stump formed of cork, using the crayons again wherever it is necessary, and again blending with the cork; the rubbing, in this case, should be with the side, and not with the point of the stump. The imitation of India ink drawings might be successfully essayed in this way.

On the combination of different Lithographic processes, in the execution of the same design.

When an artist has habituated himself to the different methods of drawing upon stone, so as to have acquired a correct judgment of their respective merits, and of the effects which they produce, he may then combine them together, and give to his compositions a degree of perfection, which could not be obtained from either singly. The masses, for example, may be executed with crayons, or in the aquatinta manner; the skies, and the details in architecture, by the mode of imitating ordinary engravings upon copper; the camel's-hair pencil, or the method for imitating wood cuts, to characterize the more delicate parts, to give the necessary relief, or to graduate the shades, in different plans and designs. Practice and good taste, are the best guides in these particulars.

When great softness and harmony are desired, the designs are sometimes printed upon a light gray chinese paper; otherwise a second stone is used, which is rubbed with oil upon all those parts which correspond with the ground of the drawing. The proper tint is given to this ground, by a roller charged with the varnish, without any lamp-black; upon this the impressions are placed, and passed again through the press; particular care being taken, that the lines surrounding the design, correspond exactly with those formed upon the second stone. The effect of a strong light is produced by cutting the stone, so that the rollers in passing over it, may not touch those parts where these lights are wanted.

On Tracing pieces of Music upon Stone.

Notwithstanding lithography offers many advantages over the method usually pursued in engraving and printing music, it has been almost totally neglected in France. There is a town in Germany, where from twelve to fifteen presses are constantly employed on this kind of work; and it is only necessary for our artists to habituate themselves to it, to execute it with great economy.

The *autographic* method may be pursued for obtaining impressions

of pieces of music; this process has been already explained, and consists in writing the music upon autographic paper, and transferring it on to the stone, with the necessary precautions. The music, however, may be written directly upon the stone; but this requires more time, and is more difficult to execute than the former, as it must be written backwards. This difficulty may be removed by practice, which will soon render the process extremely easy. The first operation is to mark upon the stone with a crayon, the position of the lines, and the spaces between them, with such other particulars as may be wanted. The five lines which form each division are traced at once, by a proper instrument charged with ink. When these are completed, the cliffs, the bars, and other signs or marks, are drawn with a metallic pen; the heads of those notes which are to be black, are formed by a piece of brass wire, with a face of the proper size, covered with fine lines; this is dipped into the ink, and applied lightly to the stone; the heads of those notes which are to be white, are formed with the pen, as are also the tails of the notes, and the lines by which they are united. The stone is prepared, and the impression taken, in the same way as in other kinds of drawings or writings.

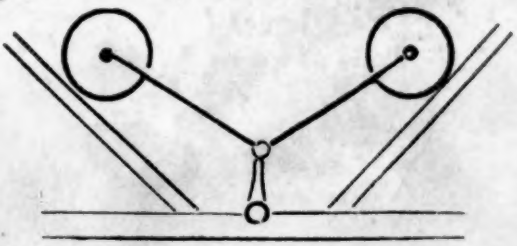
Observations on the supposed Loss of Power, in the alternate motion of heavy weights. *By* JOHN W. BAKEWELL, ESQ.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

SIR,—I have the pleasure of enclosing some observations on the supposed loss of power, by an alternate motion of heavy weights, which, I hope, may be thought of some interest by the readers of the Franklin Journal.

The gentleman who will hand you this letter, will be able to give some description of a model which I have had made, to exemplify the position endeavoured to be sustained.

The model was made by engineers, who, in following the ideas induced by their profession, have added so much strength, and consequently friction, that it very imperfectly shows, what it was intended to do. It consists of a shaft, turning in a horizontal position, with a crank at each end, in opposite directions; to each of these cranks are attached, (by small connecting rods,) two brass weights, or wheels, which move, or roll, up and down inclined planes, at right angles to each other, thus:—



The means of attaching a fly wheel to the shaft, or detaching it at pleasure, were also provided in this model. When the fly wheel is *detached*, and a weight at the end of a string wound round the shaft, the velocity of the falling weight, and consequently the times of the alternations of the four weights, gradually increases, as if a fly wheel, and it *only*, were attached to the shaft.

When the string (being fast to the shaft,) has unwound itself, by the falling of the weight, it will, to a certain distance, be wound up again, with the weight in the opposite direction, and to an equal extent, (allowing for the greater friction,) as if the quantity of matter composing these alternating weights, were a fly wheel on the shaft of such size, as should give to the matter an equal velocity in the same time.*

I am, sir, &c.

THOMAS W. BAKEWELL.

Cincinnati, Ohio, March 5th, 1828.

In all propositions advanced, which contravene the generally received opinions in dynamics, the chance of their being correct is very small. And although I have frequently found myself, passing a precipitate judgment on the ideas of others, merely, because they were not "orthodox," yet, I am sometimes guilty of a like heresy.

In the present instance, my dissention from canonical faith, has reference to the supposed loss of power in the steam engine, and other mechanical agents, where an alternate motion is unavoidably given to a considerable mass of matter.

In works which treat of the steam engine, this point is generally brought forward, when comparing the respective merits and defects, of the usual alternating engine connected with a crank, and the rotatory engine. The advantages of greater facility in *making*, and the fewer practical objections in *using*, the former, are represented to be much detracted from, by the loss of power consequent on bringing a heavy lever beam, or other weight, alternately, from a state of rest, to motion, and from motion, to rest. I shall endeavour to show, that there is no loss of power in the alternate motion of a heavy weight, when connected with a crank.

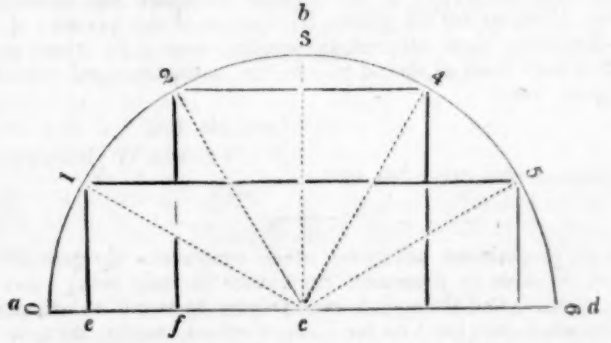
As the point in discussion relates solely to the inertia of matter,—the putting in, and out of motion,—I shall, to simplify the case, in the subjoined diagram, represent the weight, or matter, as moving horizontally.

Let *a*, *b*, *d*, represent a semi-circle described by the pin of a crank, having an equable motion around the centre *c*, the power applied in the direction from *a* to *d*, in parallel lines, throughout the semi-circle, and the weight, whose inertia is to be overcome, moving also in

* It has been thought best to publish this letter, although it was merely intended for the Editor; but the information it contains, is so intimately connected with the essay which it enclosed, as to justify its insertion.

the same parallel manner and direction. Let the dotted lines or radii represent the situation of the crank at the different points in its path.

Let the points on the line *c*, *b*, where the chords 1, 5—2, 4, intersect said line, be the true length of the leverage of the crank, from the centre, when the crank-pin is at the several points in the circle, 1, 2, 4, 5, respectively.



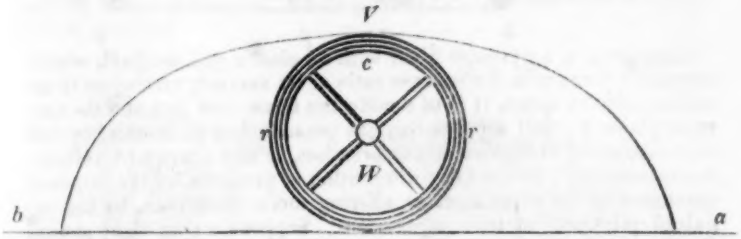
Let the lines, (ordinates,) *e*, *f*, *c*, at the points where they touch the line *a*, *d*, represent the distances passed over by the weight, during the corresponding spaces passed by the crank-pin in the arc, 1, 2, 3.

Now it is evident, while the crank-pin shall have moved in the circle from 0 to 3, it will have been retarded by bringing the weight from a state of rest corresponding with 0, to the motion acquired at 3, where the weight and crank-pin are at the greatest velocity; and it is equally evident, that the retardation by the weight connected to the crank-pin, while passing from 2 to 3, will, by the momentum acquired at 3, give an equal acceleration to it, in passing from 3 to 4. And that the sum of retardation to the crank, in passing from 0 to 3, occasioned by the weight connected to the pin, produces an equal acceleration, while passing from 3 to 6, during the stoppage of the motion acquired at 3.

I only give half the circle described by the crank, because the other half, is but a repetition of the operation.

It is not essential to the principle here attempted to be established, that the connecting rod, (pitman,) attached to the crank, and through which the power is applied, should be infinitely long, or act in parallel lines. There is no loss of power in a connecting rod, however short it may be, (an absence of friction being always supposed,) the power, with a short pitman would be unequally divided in the circle described by the crank, and would be greatest on the half adjoining to *a* in the figure. I will give the following case, as analogous to the crank. We know, that as a wheel rolls along a plane, each

point in its circumference describes in one revolution, the half of an ellipse, whose transverse axis, is the line formed by the plane, between the point where any given part of the wheel touched the plane, and its again touching the plane; *i. e.* this line along the plane, included between the two touching points, is the longer diameter of the ellipse, and is, to the conjugate axis, or shortest diameter, as twice the diameter of a circle is to its circumference.



Let *W* be a wheel rolling along a plane, from *a* to *b*, let the periphery, or rim, *r*, *r*, be of some heavy material; let us take a portion of said heavy rim as *c*, at the vertex of the wheel *V*, in which situation, (if the wheel be in motion,) it is under the greatest velocity, being double that of the centre, or axis. By rolling the wheel back to *a*, we should bring the portion of the rim *c*, to touch the plane at *a*, where it would be at rest, and by rolling it forward, we bring the portion *c*, also to the plane at *b*, where it is likewise at rest.

Here we see, that a heavy mass of matter is brought from a state of rest, at *a*, to any imaginable velocity at *V*, and again brought to perfect rest, at *b*.

The whole rim may be supposed to consist of like heavy portions of matter, which, although they balance each other, and produce an equable motion, yet, as regards the principle at issue, they may be considered in the same light when combined, as if taken separately.

Hence we perceive in this case, as in the crank, that the retardation of the wheel by the portion *c*, being brought from a state of rest at *a*, to the velocity, however great, at *V*, becomes an acceleration of equal value, in passing from *V* to *b*. If this were not the fact, the wheel would not continue to roll along the horizontal plane, until opposed by some force foreign to itself; even if it were without friction, or a resisting medium.

When the whole effect of an impulse given to a machine or engine, be resolved, or confined within itself, there can be no loss of power. When the effect, or any part thereof, be imparted to matter extrinsic to itself, there is loss of power to such engine or machine, although, strictly speaking, there can be no loss of power in nature.

If a body perfectly elastic, fall on a body perfectly hard, (unyielding,) or if the falling body be perfectly hard, and the object on which

it impinge be perfectly elastic; or again, if the falling body and that on which it fall, both be perfectly elastic, the falling body will rise to the height from which it fell, and so continue to fall and rise. I premise the above on elastic bodies, to introduce an example of another species of alternate motion.

Suppose *c*, *c*, a cylinder filled with an elastic gas, or fluid, whose expansive force is in the inverse ratio of its volume; viz. when it occupies half the space, it is of double the force; and to make the case more plain, we will suppose this gas possessed of no inertia, or that it is capable of expansion or compression, to any change of volume, instantaneously, without any diminution of pressure, by the required quickness of its expansion, or offering more resistance, by the required quickness of its compression. Suppose an air-tight piston, fitted in said cylinder as at *p*, yet, capable of moving backwards and forwards in the cylinder, without friction, and, equal quantities of the elastic gas in the equal spaces on each side of the piston; then let some force move the piston to *a*, compressing the gas at the end *b*, to half its original volume, and the gas at the other end *d*, expanding in consequence of the space afforded, to one half more than its original volume, let the force be instantaneously removed from the piston: to what distance past the centre *p*, would it be driven?

I contend, that under the above circumstances, it would be driven to within the same distance of the end *d*, and the gas be compressed to the same density as it was at the end *b*; and it would thus continue *cæteris paribus*, to alternate for ever.

No alteration of weights or quantity of matter in the piston would effect the results, except varying the times of the alternations, so long as *velocity*, and quantity of matter, are equivalents to each other.

T. W. B.

Description of a New Steam Valve.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

Sir,—Annexed is a section and front view of a steam valve that, so far as I am informed, is new; and with the partiality of an inventor, I am ready to fancy it an improvement, in some respects; at least for high pressure engines. Though similar in principle to the circular revolving valve, yet being reciprocating, it admits of the more neat movement of the concentric, and where it is desired to cut off steam, it may be effected by a cam giving a double motion.

Indeed, it appears to me that this plan combines the advantages both

of the slide and the revolving valves, inasmuch as it shuts off steam close to the ends of the cylinder, and affords a large eduction passage, which may be extended to a jacket for the cylinder, with equal convenience; it will also be observed, that, while the pressure of steam is not so great as on the slide valve; at the entrance, and at the ports of the valve, it may be made to counterbalance, so that the common objection to slide valves for high pressure engines, is here obviated, while all the advantages are retained: to this may be added the facility of keeping all tight and in good repair, only requiring packing and a stuffing box round the neck at the centre, where there is least friction.

Fig. 1.

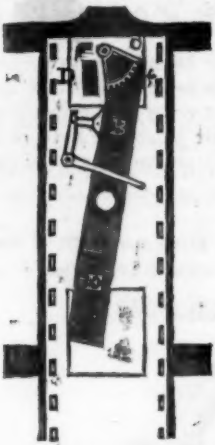


Fig. 2.

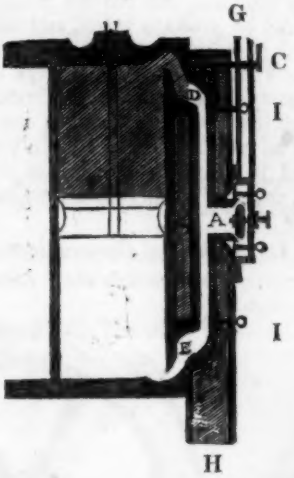


Fig. 1 is a front view, with the eduction chest off. A, the steam passage and centre of B, the valve, which is moved in the eduction chest by C, the segment with teeth, to open and shut D and E, the ports. The square dots on the sides represent flanches on the cylinder, nearly flush with the ports, to receive the eduction chest.

Fig. 2, is a section. A, neck of the valve B. C, segment. D and E, steam ports. G, induction. H, eduction. I I, screws to tighten valves.

In the section the *metal* is shaded, and the eduction is half shaded, to distinguish it from steam.

The conical valve at the neck of valve, is proposed to supply the place of the common throttle valve, regulating by a screw.

The valve would probably be better moved by a lever, instead of the segment, as at B, fig. 2, or by a rod (and link) passing directly through the side of the eduction chest.

BELIDOR.

Observations on the communication of power from a Water Wheel, with remarks upon an article on that subject, in the "LIBRARY OF USEFUL KNOWLEDGE."

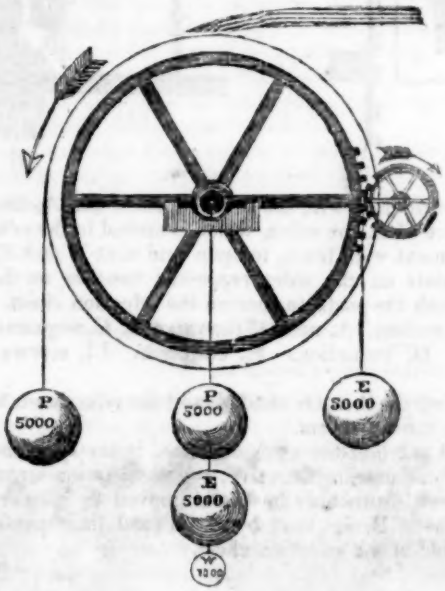
TO THE EDITOR OF THE FRANKLIN JOURNAL.

SIR,—In the 2nd Number of "Library of Useful Knowledge," article, Hydraulics, p. 28, I find the following passage.

"The power from a water wheel, ought likewise to be taken as nearly as possible at the point that is opposite to where the water is producing its greatest action on the wheel; otherwise a great, and in some cases, very unequal strain will be thrown upon different parts of its shafts and bearings, and such a one as, if it does not cause their fracture, will require unnecessary strength in them, and cannot fail to produce waste, and unequal wear, of the brasses or other bearings on which they are supported."

As I think the doctrine here inculcated essentially erroneous, I am sorry to see it in a publication so extensively useful as that in which it is contained; and in order that the error (if I prove it such) may be met by a correction in your valuable journal, I have endeavoured to illustrate the effects of the plan proposed, as contrasted with those of a different arrangement.

Fig. 1. *Method of Communicating Power from a Water Wheel, as proposed in the "Library of Useful Knowledge."*



In both the sketches of water-wheels, herewith sent, the power is taken from the segment wheel, at such distance from the centre as brings the pitch line co-incident with the centre of gravity of the bucket nearest to the pinion where the power is communicated; and this I have done rather to simplify the illustration, than because I deemed it the best circle on which to place the segment wheel.

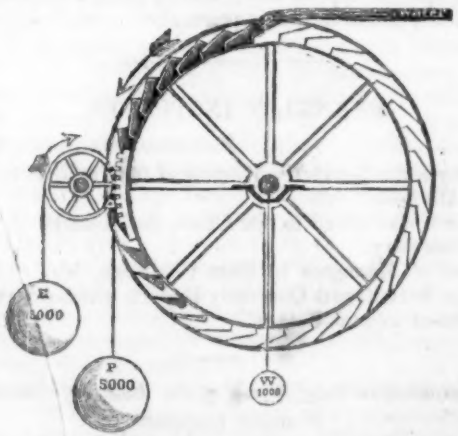
In Fig. 1, the power is taken (as recommended in the quotation above cited) from the segment wheel, "at a point that is *opposite* to where the water is producing its greatest action on the wheel." The power is hereby applied through the intervention of a lever formed by the arms of the water wheel, of which the journals in the centre, form the fulcrum.

I have assumed, for argument sake, that the power and effect are equal, although, strictly speaking, they are not exactly so. The stress on the journals will be the power, the effect, and the weight of the water wheel, added together: thus suppose

W, the weight of wheel, to be - -	1,000 lb.
P, the power, - - - - -	5,000
E, the effect, - - - - -	5,000

Then it appears clearly that the weight on the journals will be W + P + E = 11,000 lbs.

Fg. 2. *Proposed Method of Communicating Power from a Water Wheel.*



In Fig. 2. The power is taken *at that point of the descending side of the wheel where the water is producing its greatest action on the wheel:* and the power being applied immediately to produce the effect, at the centre of gravity of the descending body, the stress on the journals is only that which is incident to the weight of the water wheel; for though there is an inclination of the wheel to retire from

the pinion, yet as that is the same in both the methods, it does not enter into the comparison.

As respects the stress on the arms in Fig. 1, as they form a lever resting on the journals at the centre as a fulcrum, they must sustain (in moving) the power, the effect, and the friction of the fulcrum; and inasmuch as friction is directly as the pressures, or nearly so, if the friction on the journals of Fig. 2 = 100 lb. the friction on the journals of Fig. 1, will equal 1100 lb.

In Fig. 2, on the other hand, the stress on the arms is only that which is incident to the friction of the journals.

The following, therefore, appear to be the comparative results:

	Fig. 1.	Fig. 2.
Stress on journals,	11,000 lb.	1,000 lb.
Stress on water-wheel arms,	11,000 lb.	Only sufficient to overcome friction of journals.
Friction on journals,	1,100	100

As respects the advantage proposed to be acquired in Fig. 1, of keeping the water wheel firm in its place; the weight of the wheel is always sufficient to answer that purpose, even should the power be communicated from the centre of gyration, as is evident from the remarks of the writer himself, when he speaks of the effects of resistance at the centre of gyration. But in the recommendation to take the power at the centre of gyration, the writer is, in my opinion, making an erroneous application of known principles, and, I propose, at a future time, to examine this point also. C.

FRANKLIN INSTITUTE.

PHILADELPHIA, APRIL 24, 1828.

THE Seventeenth Quarterly Meeting of the Franklin Institute, was held in the Hall.—

Henry Horn was called to the Chair, and George W. Smith was appointed Secretary.

The Board of Managers by their Chairman, Mr. S. J. Robbins, presented the Seventeenth Quarterly Report, which was read, accepted, and ordered to be published.

The Seventeenth Quarterly Report of the Board of Managers of the Franklin Institute.

The Board of Managers of the Franklin Institute, present to the General Meeting their Seventeenth Quarterly Report, by which it will be seen, that they have, within the last three months, adopted some measures of considerable importance, which, they confidently believe, will largely contribute to the successful prosecution of the objects for which the Institute was established. The Franklin Jour-

nal, which has hitherto been the sole property of the Professor of Mechanics, has, by an agreement entered into with Dr. Jones, been assumed by the Institute, whilst the Editorship is secured to him, during his life. The terms upon which this transfer has been made, are such as it is believed will tend to promote the interest of both the parties concerned, and is, therefore, likely to be lasting. Should this not prove to be the case, the Institute will, at the termination of the year, be at liberty to place the Journal on its former footing.

In a large Society, like the Franklin Institute, the duties of some of its offices are necessarily weighty, and although they may be performed with a degree of zeal which may entitle them to the approbation and gratitude of those whom they serve, it is yet unreasonable to expect that an individual, or a succession of individuals can be found, who will be willing, or able, to devote all that time and attention, gratuitously, which the best interests of the association demand. Fully convinced of the correctness of these remarks, the Board determined to employ an *Actuary*, who should keep his office at the Institute, and who should perform the active duties of the Treasurer, be the Secretary of the Board, and of the Standing Committees, have the care of the Hall, be the Librarian, and perform sundry other services, which it is not necessary here to enumerate. Such an officer had frequently been spoken of, but the labour to be performed did not require, nor would the remuneration which it was in our power to offer, obtain the services of a person possessing the requisite qualifications. On assuming the publication of the Journal, and issuing it from the Institute, these difficulties were removed, and such an office has been created.

It is with particular pleasure that the Board announces the appointment of Mr. William Hamilton as the Actuary, a gentleman well known, from his pursuits and character, to be eminently qualified for the station.

An event has just occurred, which will deprive the Institute of the direct services of Dr. Jones; as he has received, and accepted the appointment of Superintendent of the Patent office, under the government of the United States. This will enable him to add greatly to the value of the Journal, by the publication of the most important of those numerous patents which have, heretofore, been almost unknown to the world. Whilst this measure will diffuse a mass of valuable information, it will also promote the interests of many of our ingenious fellow citizens, whose labours are unappreciated, because they are unknown.'

The board have much cause to regret, that the Institute will be deprived of the valuable services of Dr. Jones, as professor of mechanics, a station which he filled with great credit to himself, and advantage to the Institute. The appointment of a successor will claim the early attention of the Board.

Since the last Quarterly Report, a critical examination of the pupils of the high school has been held, a detailed report of which, and of the general progress, and merits of the establishment, has been published by the Committee of Instruction, which, it is unnecessary

to inform you, accords a high degree of praise, both to the instructers and the pupils.

The Lectures for the season have now closed, and the Board have the satisfaction to state, that the orderly conduct of the youths, and the general attendance, and apparent interest excited in the classes, so favourably mentioned in the last report, have continued throughout; thus evincing, in a very striking manner, the utility of the regulations which had been adopted.

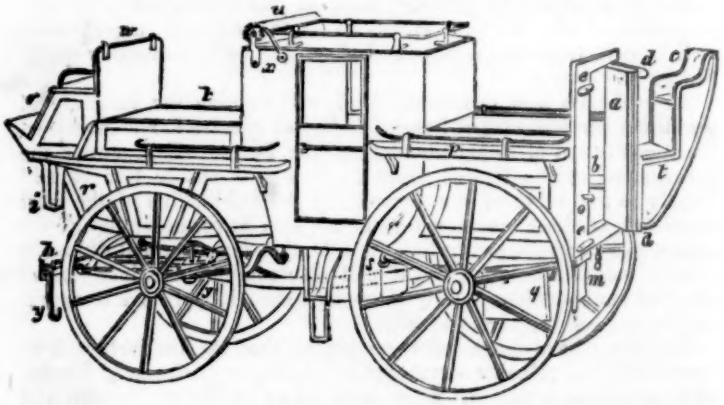
The professorship of Chemistry, rendered vacant by the resignation of Mr. Keating, has been filled by the appointment of Dr. Bache, a gentleman of undoubted attainments, and who has been performing the duties of the office for the last two years. All which is respectfully submitted, by

SAMUEL J. ROBBINS, *Chairman.*

Account of SKINNER'S *Improved Safe Coach.*

[From the Transactions of the Society of Arts.]

THE model produced before the committee of the Society of Arts, by Mr. Skinner, was considered by the coach-builders and axle-makers present, to combine, in a most ingenious and practical manner, the various improvements which for several years past have been proposed, and in part adopted, in the construction of stage coaches. So large a proportion of the travelling in this country is performed in these vehicles, that all proposals for improving them, by diminishing the labour



upon the horses, and the liability of the passengers to accidents from the carriage overturning or breaking down, have been received with great attention by the society, and rewarded, if they offered even a probability of success. The lowering the centre of gravity, by removing the heavy luggage and outside passengers from the roof of the carriage; the convenient accommodation of the latter; the adop-

tion of high fore-wheels to ease the draught; and several minor conveniences, will be found to have been duly attended to, and to be combined in the model, of which the following is a description.

The preceding figure gives a perspective view of the vehicle. The front wheels are five feet nine inches in diameter. The inside and outside passengers are seated on the same level, the floor being as near to the axletrees, as the play of the springs will admit. *a*, the door through which the hind passengers get up, the seats being situated as shown at *b; c* is a seat for the guard, attached to the door *a; d d*, iron bars at the top and bottom of the door, projecting enough to be securely held by turn buckles *e e*; the steps *g*, *h*, and *i*, serve for the front passengers and the coachman to get up by; the passengers step upon the boards *j j* on either side, and over the side rails into the compartment *k;* the steps *l*, *m*, *n*, *o*, serve for ascending into the hinder part of the coach; *p p*, boards, (on each side) over the hind wheels; there are similar ones, *j j*, over the front wheels, which have iron rails to hold small luggage. To allow of locking the front wheels, the floor is narrowed in the manner delineated; *q* is the hind boot; *r r*, the front boot; *s*, boxes opening in the floor of the coach; *t* and *v*, boxes opening in the guard's seat; *u*, a roll of leather, to cover the front passengers; it has a slip of iron along its front, which catches on the hooks *w w;* it is wound up and held tight by a ratchet-wheel and latch *x;* the end of the axis is squared to put on a winder; *y*, the locking pin, which plays though the axletree: the locking plate is under the floor and above the springs; there are five springs in front, and five at the back, two across each axletree, and four across the coach answering to them, and two more, one over each axle-tree, and rubbing on them.

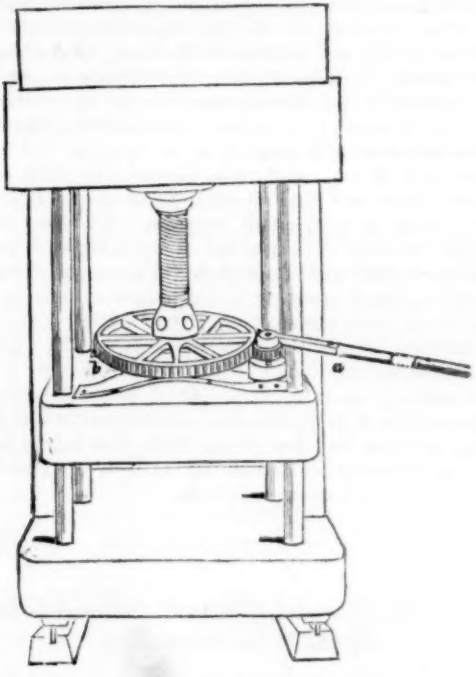
Description of the New Invented Wheel and Pinion Standing Press.

By Mr. I. L. Pouchee.

This improved press is calculated for many purposes besides those of bookbinders, stationers, and printers: for these trades, however, it is peculiarly adapted. We have not seen the press itself, our sketch being taken from a large engraving of it, just published by Mr. Pouchee; but of the advantages attending this arrangement of the component parts, there can be no question, and from its great simplicity, the expense must be very moderate: in power it may be made nearly equal to that of the hydrostatic press of Bramah: it occupies very little space, requires no *stays* either at the sides or the top, and can be worked with a small lever by one person, so as to produce an immense pressure.

There is but little in its structure that varies much from the ordinary press; the head, the bed, the cheeks, the screw, nut, &c. may be considered the same; the chief novelty consists in employing, in addition to these parts, a toothed wheel *b*, fixed on the axis of the

screw, which is operated upon by the small pinion *c*, turned by the lever *a*, the latter being shifted on the axis at every fresh pull. The power of the press when brought down to the work, may thus be increased in proportion to the difference of the diameters between the large wheel and the little pinion: the slow operation of the press at this time is of little consequence. [*Register of Arts.*



AMERICAN PATENTS.

List of Patents granted in the United States, in January and February, 1828.

FOR INVENTIONS AND IMPROVEMENTS.

In gates for locks; Daniel Rodgers, of Little Falls Town, County of Herkimer, New York, January 4.

In the hydrostatic elevator; James M'Creary, of Noblestown, Alleghany County, Pennsylvania, January 5.

Improvement called a fluid agitator, or churning machine; Samuel

H. Baker, of Wells Township, Bradford County, Pennsylvania, January 10.

In manufacturing artificial stone; Robert M'Kay, Donald M'Kenzie, and Joseph Woodhull, Caledonia, Livingston County, New York, January 16.

In the tubular steam generator; Reid R. Throckmorton, New York, January 17.

In the machine for dressing flax and hemp; John C. Wenzel, of Louisville, Kentucky, January 17.

For sundry methods, by which inflammable gases may be generated during the combustion of anthracite coal; Minus Ward & Richard Wilmot Hall, of Baltimore, January 19.

In the common turning lathe; Jefferson Moore, of Leverett, Franklin County, Massachusetts, January 19.

In the vibrating machine for knapping cloth; Samuel Duncan, of Northampton, Montgomery County, New York, January 21.

In making water proof cloth, and water proof leather; J. L. Comstock, of Hartford, Connecticut, January 21.

In the floating excavator; Harvey W. Campbell, of Lockport, New York, January 22.

In the mode by which the yards of ships, or vessels, are suspended, topped, and braced; Samuel Adams Wells, of Boston, January 23.

In manufacturing barrels, hogsheads, &c.; William Adams and Marcus Adams; the former of Ogden, Monroe County, and the latter of East Bloomfield, Ontario County, New York, January 24.

In the machine for mortising; John J. Kelogg, of Richmond, Oswego County, New York, January 24.

In the spring saddle; Thomas Harvey, of Middletown, Delaware, January 24.

In the screw water wheel; Ebenezer Beard, of Charlestown, Massachusetts, January 25.

In the plough; William Wiard, of Avon, Livingston County, New York, January 26.

In the cooking stove; Robert C. Rouse, of Athens, Green County, New York, January 26.

In the construction of presses for hay, &c.; Moses B. Bliss, of Pittstown, Kennebeck County, Maine, January 26.

In the grist mill; William L. Taylor, of M'Minn County, Tennessee, January 28.

In making Brick; David Rising, of the Town of Colchester, Chittenden County, New York, January 29.

In the steam engine, Simeon Broadmeadow, New York, January, 29.

In the steam engine, William Willis, of Charleston, South Carolina, February 1.

In making an oil paint for painting plastered walls in houses; Alexander Thompson, of Betheney, Genessee County, New York, February 2.

For a medicine, entitled improved rheumatic pills; Ezra Deane, of Biddeford, Maine, February 2.

In the manufacture of combs; Uriah Bailey, of West Newbury, Essex County, Massachusetts, February 2.

For a medicine, entitled a remedy for dysentery, dyspepsia, jaundice, and all bilious complaints; Truman Powell, of Burlington, Chittenden County, Vermont, February 2.

In the machine for packing cotton; William J. Cocke, of Cabin Point, Sussex County, Virginia, February 4.

In the machine for distilling spirituous liquors, &c.; William J. Cocke, of do. do., February 4.

For an improvement in stoves, chimneys, furnaces, and steam engines; John James Giraud, of Baltimore, February 10.

In the excavator, or self-loading cart; Waldren Beach, of Philadelphia, February 5.

In the printing press; John C. Holbrook & Elihu H. Thomas, of Brattleborough, Vermont, February 7.

In the machine for junking ivory, by the aid of water, steam, &c.; Linus Pratt and Fenner Bush, of Meriden, New Haven County, Connecticut, February 9.

In making hubs, or naves for carriage wheels, called the Hercules hub; Hercules Thomas, of the Town of Midway, Norfolk County, Massachusetts, February 8.

In the machine for breaking and dressing flax and hemp and hulling grain; Evans Christian, Town of Philadelphia, Jefferson County, New York, February 8.

In thrashing grain and grass seed, and breaking flax; David W. Webster, of Amesburg, Massachusetts, February 9.

In the machine for cutting straw; Warren Cummins, of Livingston County, New York, February 11.

In the steam engine; Isaiah Jennings, New York, February 11.

In the grailing machine; Philo Pratt, of Meriden, Connecticut, February 12.

In slitting ivory into plates for combs, do. do. do.

In the specific steam engine; Augustus S. Kirk, of Smithfield Township, Jefferson County, Ohio, February 13.

In separating and collecting gold and silver from ores, earth, &c.; William H. Folger, Spartansburg District, South Carolina, February 13.

In a machine called the apple grater; Uri Emmons, of New York, February 13.

In the canal steam boat; John F. Wight, of Erie, Pennsylvania, February 14.

In the cooking stove; Ezekiel E. Bennett, of Kingsbury, Washington County, New York, February 15.

In Lotteries; William E. Spalding, of Brooklyn, Windham County, Connecticut, February 15.

In the thrashing machine; Elias B. Hort, of Charleston, South Carolina, February 18.

In the machine for cutting, sawing, and polishing marble; Archibald M'Allester, Town of Salem, Washington County, New York, February 18.

In the machine for swingling flax; Samuel Achey, of Heidelberg Township, Lebanon County, Pennsylvania, February 18.

In the water wheel; Joseph Torrey, of Revana, Portage County, Ohio, February 20.

In the mode of fastening window shutters; Truman Bartholomew, of New York, February 19.

In the hammer for cutting and dressing granite and other stone; Joseph Richards, of Braintree, Norfolk County, Massachusetts, February 20.

In the manufacturing or preparing cotton yarn wicks, used in making candles; George Dickinson, of New York, February 21.

In the spiral water wheel; James Kelly, of Jackson County, Ohio, February 21.

In the mode of purifying water; Christopher Hall, of Norfolk, Virginia, February 22.

In the thrashing machine; Edmund Warren, of New York, February 22.

In cast iron window sashes; Isaac M'Nary, of Stafford, Tolland County, Connecticut, February 23.

In steam boilers for using stone coal; James G. Wilson, of New York, February 22.

In the machine for spinning wool, flax, and hemp; Theodore Thomas Abbot, of Greenland, Rickingham County, New Hampshire, February 26.

In manufacturing shovels; Elizabeth H. Bulkeley, Colchester, Connecticut, widow of Chauncey Bulkeley, deceased, February 28.

NOTICES.

NEW ARRANGEMENT IN PUBLISHING AND DISTRIBUTING THE FRANKLIN JOURNAL.

The publishing office of the Franklin Journal, will, hereafter, be at the Hall of the Institute. The Editorial department will remain unchanged, but the work has become the property of the Franklin Institute. Mr. William Hamilton has been appointed *Actuary*, and all communications relating to the subscription to, or the distribution of the Journal, should, hereafter, be addressed to him at his office. Communications for insertion, or relating to the objects of the work, may be sent either to the Editor, or to the Actuary.

The distribution of a widely extended periodical, requires the undivided attention of an individual; and it is believed, that the new arrangement will insure a more prompt and efficient management in this particular, than has hitherto been found to be practicable, notwithstanding the care of the late agent. Although the principal publication office will be at the Institute, Mr. Dobson will continue to aid in the diffusion of the work, and will communicate to the Editor, or to the Actuary, whatever concerns its interests.

SPECIFICATIONS, AND ACCOUNTS OF AMERICAN PATENTS.

Since the last Number of this Journal was published, the Editor has been appointed *Superintendent of the Patent office*, and has commenced the performance of his official duties, at the city of Washington. The only change which this event will make in the publication of the Journal, will be highly favourable to it; as a valuable mass of information is thus placed at the disposal of the Editor, which will enrich his work, and put into the hands of the public the most important fruits of that mechanical genius for which our country is so eminently distinguished. Many useful inventions will thus become generally known, and their authors often be essentially benefitted, by having rescued from obscurity, or oblivion, those productions of their skill, to which they are frequently without the means of calling the attention of the public.

Upon this subject, some further remarks will appear in our next number, which could not be prepared in time for this, as it was in the press before the Editor was informed of his appointment.

Care will be taken, on the commencement of the next volume, to have the numbers issue simultaneously, at Philadelphia, and at the seat of the General Government.

New Mode of Refining Sugar.—When, in our last number, we proposed to publish the communications of Mr. J. J. Hawkins, on Howard's mode of refining sugar, we resembled those who determine to build without counting the cost. Although we had examined the process as it appeared in the successive number of the *Repertory of Patent Inventions*, we had forgotten its extent. We now find, that it occupies about forty pages of letter press, and would require six octavo plates for its illustration. The letter press might be easily condensed, but the illustrations are absolutely necessary, to the perfection of the article. The Athæneum, and other public institutions possess the *Repertory*, and the *few* who are particularly interested in mastering the subject, may find an opportunity of doing so, whilst the *great mass* of our subscribers might justly complain, were we to devote so large a portion of our work, to a subject which, although of great importance in itself, is by no means, one of general interest.